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MULTIPLE DISSIMILAR CARCINOMAS OF THE STOMACH

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AN attempt to determine with even a fair degree of accuracy the incidence of multiple malignant neoplasms obviously is fraught with many difficulties. In the first place, despite a most careful classification, one must allow for a wide margin of error in differentiation between primary and metastatic cancers. Especially is this true of those in paired organs, and of metachronous lesions. In view of the well recognized tendency of cancerous growths of one of two paired organs to metastasize to the other, few indeed are the cases wherein both of such growths can be considered primary, even though similar in size and degree of malignancy. Likewise, it would seem almost impossible to state that a second lesion which appears years after removal of an original cancer is primary in nature. Exceptions may be found in certain types of skin cancers and those which arise from colon polyps. Aside from these, however, one is seldom justified in considering as primary any but synchronous growths in the same or different organs, or the same system of organs, and these only when the probability of metastasis can be definitely ruled out.

On the other hand, it is quite possible that many multiple malignant lesions exist whose presence is hidden. A number of investigators have reported the discovery of unsuspected multiple cancers at autopsy. Ewing¹ expresses the opinion that, when minute search is carefully conducted and all forms of tumor growth included, the proportion of multiple tumors is much greater. One should also bear in mind the fact, long ago pointed out by Petersen⁶ and Hauser,² that cancer may arise from two or more centers and, by increasing in size, coalesce, forming a single lesion.

¹Read before the Postgraduate Surgical Assembly (the twelfth annual meeting) of The Southeastern Surgical Congress, Richmond, March 10, 11 and 12, 1941.

One need only study the published reviews of reported multiple malignant growths to appreciate the varied estimations of their incidence. Hurt and Broders,³ in 1932, published a series of 71 cases of multiplicity in 2,124 cancer patients, or 3.34 per cent. Owen,⁵ in 1931, reported 143 multiple malignancies in 3,000 cancer

TABLE 1.

Multiple Cancers of the Gastrointestinal Tract: Incidence in 1252 Reported Cases of Multiple Malignancies

Two or more carcinomas (Warren and Gates' collection)	66
Two carcinomas (Warren and Gates, personal case)	1
Carcinoma and sarcoma (Warren and Gates' collection)	1
Two or more carcinomas (Major's collection)	22
Total	90 (7.2%)

TABLE 2.

Multiple Cancers of the Colon: Incidence in 1252 Reported Cases of Multiple Malignancies

Two or more carcinomas (Warren and Gates' collection)	73
Two carcinomas (Warren and Gates, personal case)	1
Two or more carcinomas (Hurt and Broders, personal cases)	5
Total	79 (6.3%)

TABLE 3.

Multiple Cancers of the Stomach: Incidence in 1252 Reported Cases of Multiple Malignancies

Two or more carcinomas (Warren and Gates' collection)	30
Carcinoma and sarcoma (Warren and Gates' collection)	4
Carcinosarcoma (Warren and Gates' collection)	1
Four carcinomas (Owen, personal case)	1
Total	36 (2.8%)

patients, or an incidence of 4.7 per cent. The most comprehensive of the reviews was that of Warren and Gates,⁸ published in 1932, which included 794 cases collected from both surgical and post-mortem records as reported in the literature. In addition, they reported 40 cases of multiple lesions in a total of 1,078 cancer patients of their own, or 3.7 per cent. Their collection did not include that of Owen, nor Major's⁴ collection of 214 cases, pub-

lished in 1918. On the basis of all statistics, they found the incidence of multiple malignancies only 1.84 per cent of all cancer cases.

The author has studied these reviews with the view of determining the incidence of multiple cancers of the gastrointestinal tract, and particularly of the stomach and colon. The total number of multiple growths in the four series was 1,252. Exclusive of the skin, the gastrointestinal tract predominated as the site of the lesions in the collection of Warren and Gates. This may be attributed, in some measure, to the presence of malignant polyps in the colon. The following tables show the number of cases listed. Those mentioned in the colon and stomach are not included in the group of gastrointestinal cancers.

The author's interest in this matter was aroused largely by the recent finding of two types of carcinoma in the same stomach. On going into the literature, it was discovered that Schneider,⁷ in 1940, had made a study of multiple malignancies of the stomach of dissimilar types, and had found only twenty-five cases reported. Sixteen of these he rejected for statistical purposes, because of lack of detail. To the remaining nine he added another of his own. Assuming Schneider's computation is well founded, the author's case, which follows, is therefore the eleventh reported wherein two distinct types of carcinoma of the stomach were unquestionably present in the same individual.

REPORT OF CASE

Mr. M., aged 55, was first observed on Dec. 13, 1939. His family history was negative for cancer. According to his personal history, for two years he had suffered with intermittent attacks of nausea and vomiting. In the beginning of only mild degree, after several months the attacks became more severe, causing considerable distress. He had been examined elsewhere one year before, but no evidence of disease had been found at that time. The nausea and vomiting had persisted at intervals, and during the three weeks prior to his visit, he had been vomiting food taken the previous day. Three weeks earlier, also, he had noticed a mass in the "pit of his stomach." Since then, he had grown steadily weaker, and had lost 25 pounds.

EXAMINATION.—The patient had the emaciated appearance commonly associated with advanced destructive lesions. In the upper left quadrant of the abdomen a movable mass could be indistinctly palpated. The supraclavicular glands were not enlarged, nor could any masses be found on the rectal shelf. Studies of the blood revealed 58 per cent hemoglobin, 3,600,000 red cells, and 5,000 white cells. The Wassermann and Kahn reactions were negative. Nothing else of significance was found on physical examination.

A roentgenogram of the stomach disclosed a bizarre deformity characteristic of an infiltrative type of growth, beginning at the pyloric ring and extending proximally three inches, with a definite narrowing of the ring. In addition to this, on the lesser curvature near the cardia was a large, barium-

filled niche, which presented the appearance of a penetrating lesion. The bowel wall was normal between the two defects. The esophagus, duodenum and remaining portions of the intestinal tract were negative. The roentgenographic diagnosis by Dr. J. H. Herring was multiple lesions of the stomach, probably malignant, the larger being at the pylorus and the other near the cardia on the lesser curvature (fig. 1).



Fig. 1. Preoperative roentgenogram of stomach, showing definite deformity and filling defect at the pylorus, and barium filled niche on the lesser curvature near the cardia.

OPERATION.—An exploration was carried out on Dec. 16, 1939. On opening the stomach, two distinct lesions were found. The distal one, which was at least $2\frac{1}{2}$ inches in diameter, almost encircled the pyloric end of the stomach and extended up to, but did not involve the duodenum; the larger portion of this growth was on the lesser curvature. A considerable amount of obstruction was present. The second lesion was situated on the lesser curvature posteriorly, and extended to within one inch of the cardia; it was slightly smaller than the first and was probably the younger of the two. The tumors were separated by approximately $2\frac{1}{2}$ inches of normal stomach wall. Both were of the ulcerative type, their craters being typical of carcinoma. The stomach was movable. There were several enlarged glands along the lesser curvature and still larger ones in the subpyloric group; clinically, they were definitely involved in the malignant process. No other glands nor metastases could be found by palpation. The liver was slightly enlarged, but free from metastases. The gallbladder was not diseased. The appendix was not examined.

Even though the condition was unpromising, sub-total gastrectomy was done, all the stomach being removed with the exception of a small portion

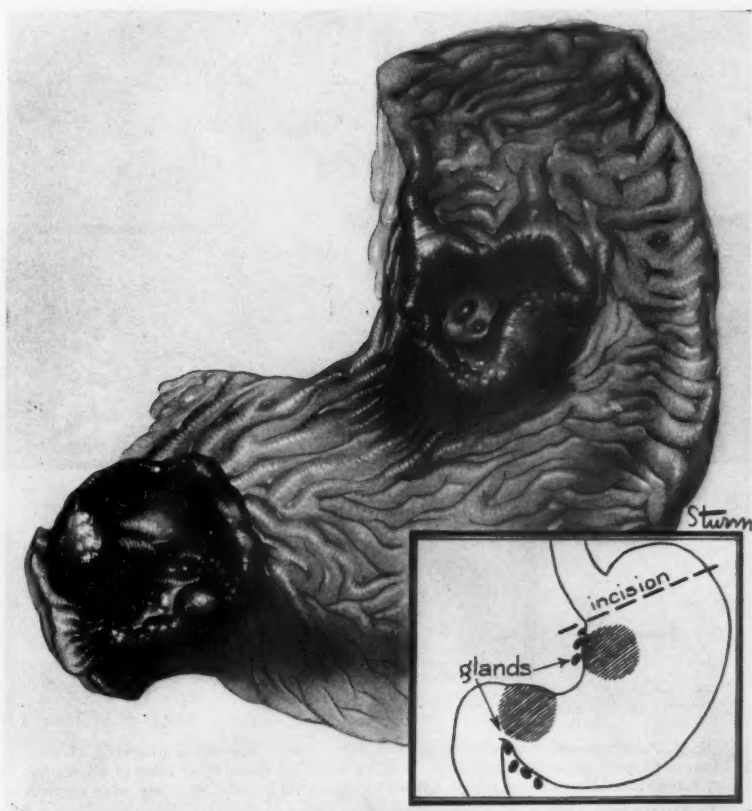


Fig. 2. Drawing of open resected portion of stomach, showing the two lesions, one at the pylorus and the other near the cardia, with intervening normal stomach wall. The growth at the pylorus was the larger of the two and probably the older. Insert shows the location of the lesions and the extent of glandular metastases.

near the cardia. All the subpyloric group of glands and those along the lesser curvature were excised en masse with the stomach. In order to extirpate these glands, it was necessary to ligate the middle colic artery; although this disturbed the blood supply to the transverse colon, a sufficient amount remained to sustain its vitality. After the resection, it was possible to reestablish continuity of the gastrointestinal tract by uniting the remainder of the stomach to the side of the jejunum posterior to the transverse colon, as a posterior Polya anastomosis.

A transfusion of 500 c.c. of blood was administered during the course of the operation and the patient was in satisfactory condition at its conclusion. His convalescence was smooth and the wound healed primarily. He was dismissed from the hospital on the twentieth postoperative day, with instructions to follow a dietary regime with frequent small feedings.

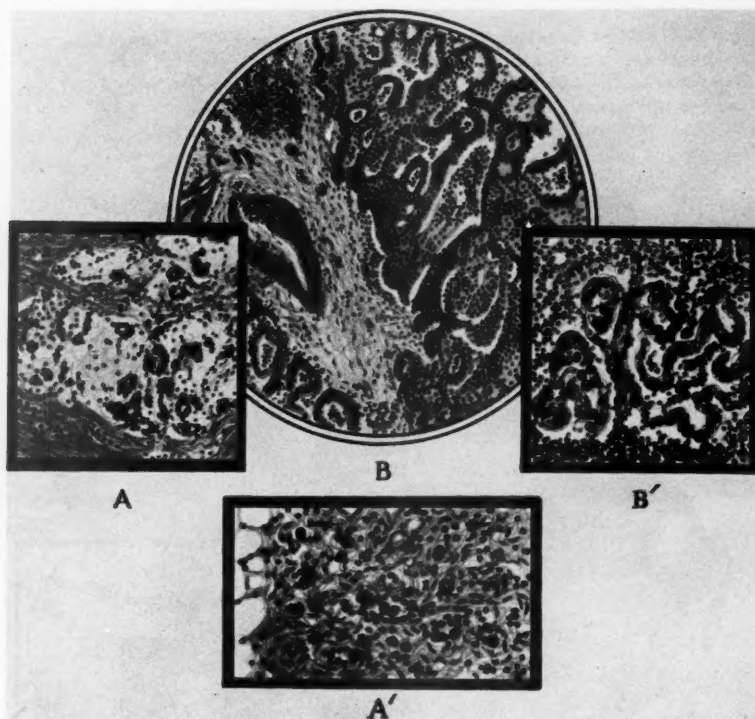


Fig. 3. A. Microscopic section of growth from lesser curvature, showing alveoli distended with gelatinous material. The cells lining the alveoli present all stages of formation. Diagnosis: Colloid adenocarcinoma on lesser curvature near cardia.

A'. Microscopic section of gland adjacent to lesser curvature. Small masses and strands of epithelium are interspersed with fibrous tissue and lymphoid elements. The cells are irregular in size and shape, and staining reaction. Diagnosis: Malignant gland, metastatic from colloid adenocarcinoma near cardia.

B. Microscopic section of growth from pylorus, showing compactly grouped alveoli composed of many layers of round and cylindrical cells with hyperchromatic nuclei. Several of the alveoli are distended with exudate. Diagnosis: Medullary gastric carcinoma at pylorus.

B'. Microscopic section of subpyloric gland, showing the arrangement of cells in alveoli. The cells are round and cylindrical, their nuclei hyperchromatic. Diagnosis: Malignant gland, metastatic from medullary carcinoma at pylorus.

GROSS PATHOLOGIC FINDINGS.—(by Dr. N. E. Leake). The specimen consisted of a section of stomach measuring 26 cm. in length and 14 cm. in circumference. There were two elevated sessile lesions on the mucosal surface; the smaller, situated on the lesser curvature, was 7 cm. in diameter, and the larger and more elevated growth, at the pylorus, is 8 cm. in diameter. They were separated by approximately 65 cm. of normal mucosa. Both masses contained ulcerated craters, and both had indurated, rolled edges. The edges of the larger growth were undermined, and over its serous coat there was considerable retraction and fixation. The subpyloric mesenteric attachment contained a number of enlarged lymph nodes, which were grayish-white on sec-



Fig. 4. Roentgenogram, May 16, 1940, showing remaining portion of stomach 6 months following resection, with satisfactorily functioning anastomosis.

tion. The lesion on the lesser curvature was covered with mucus, and on section presented irregular cavities distended with gelatinous material. The adjacent glands were enlarged, indurated, and grayish-white on cut section (fig. 2).

MICROSCOPIC FINDINGS.—(Growth from lesser curvature).—The structure of this specimen was that of simple adenocarcinoma with the production of thin mucus. The mucus filled all but the youngest alveoli to distention. The lining cells of the alveoli presented all stages of formation; many cells were desquamated and dissolved in the mucus. In the infiltrating portions of the growth the cells had become ballooned with mucus and the nuclei had been compressed into signet ring forms.

GLAND FROM REGION OF LESSER CURVATURE:—The section presented small masses and strands of epithelium interspersed with fibrous tissue and lymphoid elements. The cells were irregular in size and shape, and in staining reaction. Many of the nuclei had been compressed into signet ring form by mucus within the cells.

GROWTH FROM PYLORUS:—The specimen contained elongated, sacculated, glandlike structures which tended to become alveoli compactly grouped and having little stroma. Many of the lumina of the alveoli were small, while others were distended with exudate. The alveoli were composed of multiple layers of round and cylindrical cells with hyperchromatic nuclei.

SUBPYLORIC GLAND:—The lymphoid structure beneath the capsule was invaded by gland-like formations of epithelium which tended to become alveoli. The cells were round and cylindrical, their nuclei hyperchromatic.

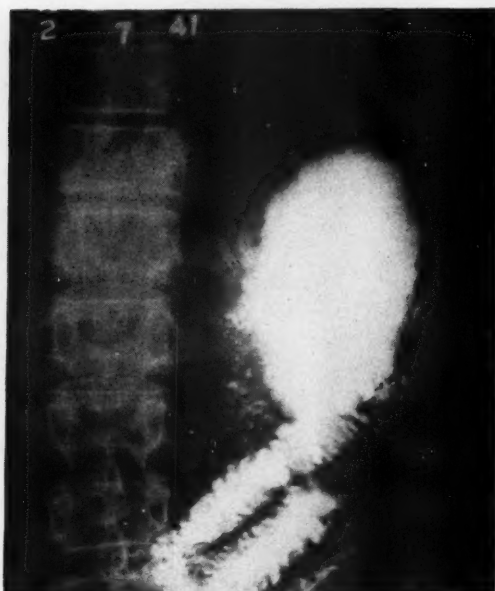


Fig. 5. Roentgenogram, Feb. 7, 1941, showing remaining portion of stomach with satisfactory function of the gastro-enterostomy, approximately 14 months after operation.

PATHOLOGIC DIAGNOSIS.—Multiple dissimilar carcinomas of stomach with glandular metastases. (1) Colloid adenocarcinoma of lesser curvature, with metastases to adjacent lymph nodes; (2) medullary carcinoma of pyloric region, with metastases to subpyloric lymph nodes (fig. 3).

FOLLOW-UP:—Upon his return in May, 1940, the patient reported that he was feeling well, his appetite was good, and he was having no digestive disturbance. His blood picture had materially improved and he had gained several pounds in weight. A roentgenogram made at this time revealed good function of the stomach and no evidence of recurrence nor of metastases (fig. 4).

When seen again, in August, 1940, the patient was still gaining strength and weight, and was able to eat without discomfort any food which he desired. His blood count was normal. Nothing was found on physical examination to indicate a recurrence.

The patient was last seen on Feb. 7, 1941. He then stated that his general health had remained good, his appetite was satisfactory, and he was taking a fair quantity of food five or six times daily without experiencing any distress. His weight had been maintained. Clinically, there was no sign of recurrence. The roentgenogram disclosed some irregularity at the stoma, though the roentgenologist was uncertain whether this was evidence of a recurrence.

The following table presents the cases of multiple dissimilar

carcinomas of the stomach collected by Schneider, with his personal case and that of the author, described above.

TABLE 4.

<i>Multiple Carcinomas of Dissimilar Types of Stomach</i>	
<i>Author</i>	<i>Types of Lesions</i>
Hauser	{ Carcinoma solidum simplex of fundus { Medullary adenocarcinoma of pyloric region
Borst	{ Solid medullary carcinoma of pylorus { Colloid adenocarcinomas of lesser curvature
Borst	{ Scirrhus carcinoma of pylorus { Cylinder-cell carcinoma of fundus
Mönckeberg	{ Solid medullary carcinoma of lesser curvature { Medullary adenocarcinoma of pylorus
Tsunoda	{ Medullary carcinoma of greater curvature { Adenomatous cylinder-cell tumor of greater curvature
Spranger	{ Carcinoma simplex of lesser curvature { Adenocarcinoma of lesser curvature
Steden	{ Colloid adenocarcinoma of lesser curvature { Solid carcinoma of lesser curvature
Müller	{ Colloid carcinoma of pylorus { Anaplastic small-cell carcinoma of cardia
Müller	{ Adenocarcinoma of pylorus { Anaplastic small-cell carcinoma near cardia
Schneider	{ Adenocarcinoma of lesser curvature { Medullary carcinoma of pylorus
Sanders	{ Medullary carcinoma of pylorus { Colloid adenocarcinoma of lesser curvature

NOTE: The first ten cases are summarized from Schneider's paper⁷.

In this connection, the author wishes to mention another case, that of a double carcinoma of the colon in a man 57 years of age, encountered in May, 1937. The condition was particularly remarkable in that one of the lesions extended from the ileocecal valve to the hepatic flexure. The second growth, which was less than half the size of the first and probably the younger of the two, involved the distal portion of the transverse segment. The masses were definitely independent; both arose from the mucosal surface, and between them was a segment of normal bowel 12 inches in length. It was necessary to resect the colon to the splenic flexure. Four years, eight months have elapsed since the operation and the patient is still in good health.

COMMENT

According to the author's clinical observations, the incidence of multiple malignant neoplasms is less than 1 per cent, exclusive of metachronous growths and those in paired organs. Despite this small percentage, it is believed that multiplicity is an expression of a heightened predisposition of the individual to cancer, rather than a mere coincidence. Multiplicity, however, does not necessarily influence the prognosis unfavorably. As in single cancers, life expectancy depends largely upon the type of the growth, the extent of metastases, and one's success in completely eradicating the disease.

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CONSERVATISM AND PELVIC INFLAMMATION

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THE remarks in this paper are well known, but in our eagerness to do greater things we are inclined to forget basic principles and pass up the knowledge we already have for doing sane and practical surgery. Pelvic inflammatory disease is a name given to the diffuse infection of the generative organs of the female pelvis. This paper will attempt to discuss in short, gonorrheal infection above the cervical canal and more in length, the cellulitis group of pelvic infections, which are chiefly post-abortive infection and puerperal infection.

Gonorrheal disease ascends from the lower genital tract, through the uterine cavity to the adjacent pelvic peritoneum and contiguous viscera. The spread of the disease is along the mucous membranes, and it is chiefly a disease of the mucous membranes. The uterine tubes are favorite sites for the proliferation of the gonococcus. It is estimated that 70 to 80 per cent of all cases of salpingitis is of gonorrheal origin, which is almost invariably bilateral. Occlusion of the fimbriated end of the tube is usual with accumulation of serous or purulent material in the outer end and dependent portion. Thus we have "pyosalpinx." If an ovary is involved in the mass, we have a tubo-ovarian abscess. There may develop more or less pelvic peritonitis with adhesions to the loops of bowel, omentum and peritoneum. This is nearly always the case of gonorrheal salpingitis of any degree of severity. The appendix is often secondarily involved.

Combined clinical and pathologic study indicate that a single gonococcal infection of a tube has relatively mild pathologic changes. Greatly thickened and chronically diseased tubes are the result of repeated infections. Although a single attack tends to result in a clinical cure, often the tubes remain occluded and sterility is the result. It is known that the gonococcus does not live long in the tube, as the organism is rarely found in the pus two weeks after the disappearance of fever and leukocytosis. It is therefore logical to conclude that gonorrheal salpingitis is a self-limited process and that persistently active gonorrhea of the tubes is ascribed to recurrent infection, rather than to chronic infection. Male carriers need not be the source of reinfection, as the gonococcus remains viable in the lower genital tract a long time, and reinfection may result from trauma to the cervix or from the passage of douches upward through the cervical and uterine passages.

The diagnosis of acute gonorrheal disease of the tubes is made

by the history, symptoms, physical and laboratory findings. A history of exposure and suggestive symptoms of previous genital infection is often available. Examination of the husband or consort may be of aid in the diagnosis. Pain is always present, most often bilateral, localized in the pelvis and is quite severe. Temperature ranges from 102 to 103, and the white blood count is most often around 18,000. Persistent vomiting is uncommon. Chills are also uncommon, which is an important symptom in differentiating pelvic gonorrhea from post-abortive infection. Examination reveals a variable amount of abdominal distention with marked tenderness in the lower abdomen, but with only moderate rigidity. Pressure on, and manipulation of the cervix causes pain in the region of the tubes. Free mobility of the uterus is unusual. Most often it is retrodisplaced, tender and somewhat fixed. The tubal regions are also tender, with a palpable inflammatory mass in one or both sides, or often behind the uterus. The finding of the gram negative intracellular diplococcus in smears from the lower genital tract proves the diagnosis of gonorrhea. The chronic disease is diagnosed by the presence of persistent pelvic pain, pain on defecation, menstrual disorders with excessive and irregular menstruation and by pelvic examination which reveals the same as above except for larger masses and more fixation of the uterus.

The treatment for acute tubal infection should be essentially non-surgical, which is the consensus of leading gynecologists of the United States and Europe. Operative intervention may be required in pointing culdesac abscess, by drainage through the vagina, or for relief of abdominal complications, such as intestinal obstruction, or an involved gangrenous appendix. In favor of conservative management, it must be born in mind that 85 per cent of patients with acute salpingitis progress to recovery without the need of surgery. The proper and conservative treatment is rest in bed with plenty of liquids and a simple nourishing diet. The use of purgatives aggravates the condition and is contraindicated. An enema every other day, if necessary, is preferable. Pain is relieved by the use of ice bags and codeine. After the acuteness of the infection subsides, the use of hot applications, hot sitz baths, or better, the use of intrapelvic application of heat by means of the Elliott machine or diathermy is indicated. Such treatment causes the inflammation to subside rapidly and even large inflammatory masses resolve. Foreign protein therapy may or may not be of benefit.

Since 85 per cent of the acute cases come to a clinical cure without surgery, there are left 15 per cent which do come to operation for relief from the sequelae of salpingitis, and not for the acute condi-

tion. Indications for operation then, are (1) Painful displacement of the uterus, (2) Adhesions with symptoms, (3) Uterine bleeding, (4) Giant size hydrosalpinx, and tubo-ovarian abscess, and (5) Patients, who despite warning, repeatedly subject themselves to re-infection.

The cellulitis group of pelvic infections, caused by the streptococcus, are much more serious and an appalling number of women of child-bearing age have suffered acute illness, chronic illness and death, as a result of this type of infection. The most frequent causes of this type of infection are abortions and puerperal infection. Criminal abortion has been second only to gonorrheal disease, as a cause of pelvic infections. As already stated, gonorrheal disease, extends along the mucous membranes to the pelvic structures and is more or less self limited. In contrast, infection following abortions extend through the wall of the uterus by means of lymphatics and blood vessels, and then invade the cellular tissues. The tubes are attacked from without, instead of by extension from within. The severity of the disease varies with the virulence of the infection and the resistance of the patient. Sometimes there is little trouble, again there is prolonged streptococcic infection and too often there is generalized sepsis and death.

The infection is started by intrauterine instrumentation which inoculates a fertile medium with the streptococcus. It is generally recognized that endometrium of body of the uterus tends to be free from chronic infection and that a non-gravid uterus is resistant to the infection. The interior and the contents of a gravid uterus are sterile and any invasion of the uterus will carry with it the likelihood of infection. The high incidence of virulent vaginal and cervical bacteria in patients with a discharge makes it almost impossible to enter the uterine cavity without introducing bacteria. The infectious process often begins at the placental site and less frequently at unhealthy and injured places of the endometrium and at lacerations of the cervix. The infection spreads from the point of inoculation by way of the lymphatics and blood vessels through the uterine walls to the broad ligaments, tubes and ovaries. The body of the uterus tends to be increased in size, congested and firm, but with the more virulent infections it may be soft, boggy and necrotic. In the latter, autopsy reveals thrombosed veins, edematous myometrium, infection throughout and a necrotic placental area. The cellular tissues and veins of the broad ligaments reveal infected thrombi, and serous exudate or pus.

Ovarian abscesses are frequent. These may attain a large size. A post-abortion pelvic mass in a patient whose fever remains high,

week after week, is suggestive of an ovarian abscess. The tubes are attacked, if involved, from without and the process begins a perisalpingitis. The interior of the tube often escapes and the patients do not become sterile. However, hydrosalpinx, pyosalpinx, and permanent occlusion of the tube does occur.

Pelvic peritonitis and intestinal adhesions are more severe than in gonorrheal disease. Generalized peritonitis occurs, but not so frequently as it formerly did, although sepsis and death are not uncommon. Thrombophlebitis of the femoral veins sometimes occurs. Later in the course of the disease, there is a boardlike cellular exudate in the region of one or both broad ligaments. The uterus is retrodisplaced less often than in gonorrheal infection. The pelvic adhesions are more firm and resistant to separation by blunt dissection.

The diagnosis of post-abortive infection should not be difficult; however, a history of instrumentation may be obtained with utmost difficulty. Details of the history should include the nature of interference and the number of times of invasion. Bleeding from a woman, of childbearing age, accompanied by chills and fever, should suggest the possibility of abortion, and especially if there is a history of a missed menstrual period. Chills are of diagnostic importance. They indicate invasion of the blood stream by infection and thrombophlebitis of the uterine vessels. Examination in the earlier stages may reveal only a bloody discharge, with, to a varying degree, an offensive odor. Pelvic pain is present with tenderness and rigidity over the lower abdomen. There is often a palpable, boardlike mass in the cellular tissues between the uterus and the bony pelvic wall. As already stated, the uterus is increased in size and usually more firm than the normal pregnant uterus, due to the congestion and infection. The uterus is fixed, because of adhesions to the bowel and omentum.

The course of the ordinary infection tends to spontaneous recovery. A history of curetment in a woman infected and having chills is unfavorable. Likewise, curetment of a patient, who has been packed with gauze makes the prognosis more doubtful. Bacteria remain viable in the pelvic tissue a long time after the patient is apparently well. It is recorded in one case that virulent streptococci were isolated eighteen years after a post-abortive infection.

Puerperal infections cause the same pathology, the same symptoms and the chances of the same outcome. The discussion here is a word about prevention. The present day avoidance of unnecessary vaginal examination before delivery is to be commended. Lack

of surgical cleanliness, unnecessary invasion of the genital canal and trauma to the parts are principal causes of avoidable puerperal sepsis. Although unavoidable sepsis might occur from virulent organisms harbored in the genital tract, and necessary manipulations, such as the application of forceps, executing versions, etc. Carriers of the streptococcus are a serious menace to a parturient patient, and all who attend them should wear a mask of several thicknesses of gauze over the nose and mouth. Other causes of pelvic cellulitis are stem pessaries, and contraceptive buttons which cause irritation and invite infection. The electric cautery knife used in a virulently infected cervix may cause the condition. Radium when used in the presence of infection is an important cause and is a considerable risk to the patient when subjected to its use. High pressure douches may carry infection through the uterine cavity and cause the infection of all the pelvic structures.

An important principle in the prevention of pelvic cellulitis should be borne in mind, and that is, never in the presence of an active infection, irrespective of origin, curette or do instrumentation within the uterus unless it is imperative. The exceptions to the rule are hemorrhage which endangers life, and occasional curetment which might be necessary for diagnostic purposes. In case of incomplete abortion, without infection and with persistent bleeding, a cleaning out might be justified, provided nature and oxytoxics be given ample opportunity to check the bleeding, which they will do in practically all the cases. Packing infected cases with gauze is extremely dangerous, and inexcusable. Packing of a clean uterus might be necessary and justified.

In the past, volumes have been written on the "indications for surgical intervention in post-abortive and puerperal infection," and all procedures from curetment to hysterectomy have been advocated. Authorities on gynecology at the present time agree that the only surgery indicated in acute pelvic inflammation is for complications and emergencies which endanger life. The secret to the success of treatment in acute pelvic infection is non-interference. The exceptions are hemorrhage, pointing abscesses, and other pus accumulations. Rest in bed in Fowler's position, ice bags, fresh air, sleep, nourishing foods, and fluids are essentials in the treatment. Repeated blood transfusions at three to five days intervals are indicated in the anemic and very septic patients. Unnecessary pelvic examinations should be avoided, and the necessary ones done with extreme gentleness. Antistreptococcic serum seems to be of some benefit. Sulfanilamide and sulfathiazol have apparently given spectacular

results in many cases, and they possibly are the most valuable drugs we have at the present time.

It has already been emphasized that removal of tissue for the purpose of eradicating infection in gonorrheal disease is seldom necessary, because the disease tends to be self-limited. As already stated, virulent organisms remain viable following cellulitis for months, and possibly years. For this reason radical surgery is dangerous and the results are unsatisfactory unless long postponed. If elective surgery is done in the presence of viable virulent organisms, one might expect serious exacerbations of infection, a stormy convalescence, or even death. Indications for surgery for the sequelae of pelvic cellulitis are: persistent pelvic pain due to adhesions; chronic ovarian abscesses; inflammatory masses, like pus tubes, or hydrosalpinx, which cause pain, interfere with function and are detrimental to health; uterine bleeding; chronic intestinal obstruction caused by adhesions; displacement of the uterus which causes symptoms; and in selected cases of sterility. A period of at least six months and possibly longer should intervene between the subsidence of the acute infection and the time of elective operative procedures.

A fairly good idea as to safety of operation following infection may be determined by the use of the sedimentation test, which is held more delicate and more accurate than the leukocyte count. In general, rapid sedimentation indicates active infection, whereas a sedimentation time of one hour indicates relative safety, and two hours indicates no infection.

This test was used as an index in a medium sized hospital over a period of three years on 200 infected pelvic cases, without a fatality due to infection.

SUMMARY

1. In the past, too much surgery has been done in the presence of pelvic infection.
2. Conservative measures are logical and give the best end results.
3. Definite indications should be had for surgical interference in acute cases.
4. The degree of safety for operation in the latent cases should be determined.

PATHOLOGY AND SURGICAL MANAGEMENT OF ACUTE HEAD INJURY

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A GOOD understanding of the pathology and pathologic possibilities in acute head injury is extremely valuable in the surgical management of these cases. At times it proves the futility of attempts at treatment, and then again it may show the way for better management of other cases. The Grace and Receiving Hospitals in the City of Detroit, have ample head injury material and they have been the largest source of the clinical material in this discussion. The Wayne County Coroner's Office has also been most cooperative in allowing a study of routine material at their disposal. Admittedly, a thorough discourse on the subject suggested by the title of this paper, is beyond its scope. A discussion of some of the more important problems confronting the physician in the management of such cases will be attempted.

Trauma to the head may be brought about in two ways. First, by direct blow, that is, a moving object may hit the head, and two, the head may be injured indirectly, that is, the human body in motion may come in contact with a non-moving, or slower moving object. When the head in motion is stopped by a slower moving or non-moving object, the intracranial contents may crowd against the bony incasement with ensuing tears and bruises of the brain surface. As concerns deeper lesions, in indirect blows of the head, the various portions of the intracranial contents once put in motion may come to a stop with different degrees of force causing damage and tears in deeper parts of the nervous system. When the head in motion is stopped by a slower moving or non-moving object, there may be crowding of the various portions of the nervous system of different density against each other with consequent tears and bruises within the substance of the nervous system. Such lesions would not ordinarily obtain with direct blows.

The significance of this etiologic division should not be forgotten in the management of these cases. A direct blow is more apt to cause a local lesion at the point of impact. With indirect blows, it is much more common to obtain multiple lesions, not only of the nervous system, but other portions of the body.

The greatest number of cases of head injury belong in the latter group, so that in their management, the physician should treat the body as a whole. The injured head may receive the most attention,

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but in its management we should not overlook broken ribs, fractured vertebrae, intra-abdominal and pelvic injuries.

The presence or absence of fracture of the skull by x-rays has been repeatedly considered of major prognostic significance. It is true that a fracture is a rough index of severity of blow, and associated damage to the intracranial content is more common among those with fracture but its absence does not rule out severe and at times, fatal intracranial injury. In 158 consecutive autopsy cases of head injury, 49 had no fracture of the skull. Associated trauma elsewhere in the body was thought responsible for death in 7 out of 94 cases with fracture. In 39 cases with no fracture of the skull, there was no trouble except in the head in 20. Therefore, these 20 patients with no fracture of the skull, died solely of traumatic intracranial lesions. Particularly with indirect injury to the head, the movement of the brain in the cranial cavity may produce contusions and tears even though the skull may not be fractured.

The most common pathologic findings in the autopsy cases was contusions of the brain surface with softening. Forty-five and three tenths per cent showed such lesions. About one-third of the group displayed small hemorrhages throughout the nervous system. In cases of epidural and subdural hemorrhage, associated bruises of the brain and petechial hemorrhages, or both occurred frequently. This further complicates the surgical management in this group.

Contusions and bruises of the brain surface were most frequent on the orbital surface of the frontal lobe and the junction of the frontal and temporal poles of the hemisphere, on one or both sides. The highest incidence of bruises in this neighborhood is due to the many bony irregularities against which the brain rests. The floor of the anterior fossa, the lesser wing of the sphenoid, causes many contusions when the brain, in motion, abutts against this relatively immovable and irregular bony incasement. In injuries in which the direction of the blow causes the intracranial contents to move posteriorly, much is accomplished by the tentorium cerebelli in protecting the brain. In some animals the tentorium is made up of bone. Comparable injury in the dog would result in contusion of the more posterior portions of the brain, rare in the human. In the dog, the osseous tentorium has not "give." Hence, impact of the moving brain against this membrane should be followed by bruises in this neighborhood. In the human, a majority of contusions occur in the anterior third of the brain surface, therefore, it is no idle observation that most cases of subdural hemorrhage occur in the frontal, parietal, and temporal regions.

An interesting cause of death among three of the consecutively

autopsied cases was fat embolism of the brain. All three had fractures of the long bones. The brain was edematous, its surface being somewhat hemorrhagic and, on section, many small hemorrhages were found particularly in the white substance. On microscopic examination, the hemorrhages were found to be about blood vessels and frequently a fat plug was demonstrated by special stains. The clinical symptoms were observed in two patients. They are sufficiently characteristic so that fat embolism should be suspected if certain symptoms and signs obtain. After a period of 18 to 36 hours, both patients went into a rapid coma with increased respirations and pulse rate. Increased tendon reflexes, bilateral Babinski were seen in both instances, suggesting a general brain involvement rather than a localized lesion. The spinal fluid was slightly bloody with a pressure of 300 mm. of water in one instance, and a pressure of 220 in the other. The patient with the bloody spinal fluid was explored for possible subdural hemorrhage. The other was correctly diagnosed as fat embolism. The changes in the state of consciousness in such cases may simulate the progressive drowsiness and coma of enlarging clots in the cranial cavity.

The pathologic material in the autopsy group suggests the following important lessons. First: In practically every case of head injury, there is a combination of pathologic changes. Second: It is astonishing to note how little may upset the human mechanism and cause death. Third: A surgically treatable acute traumatic lesion is almost always on the surface of the brain. Acute traumatic massive intracerebral clots are rare except for those occurring in the temporo-sphenoidal lobe, and very near the surface.

On the basis of rationale, operations on head injury may be classified as follows:

1. Preventive operation, the primary purpose of which is to prevent intracranial infection.
2. Corrective operation, the purpose of which is, primarily to restore deformities, and repair defects.
3. Exploratory operations for intracranial hemorrhages.
4. Operations for complications.
5. Operation primarily for decompression.

PREVENTIVE OPERATIONS

Preventive operations include the care of compound fractures, compound depressed fractures, bullet, stab and other penetrating wounds, cerebrospinal fluid rhinorrhea and pneumocephalus. It is to be noted that in these conditions there is a communication between the cranial cavity and the outside, and surgery proposes to

close such communication before infection can enter the cranial cavity. In cases of bullet, stab and other penetrating wounds, the surgeon has the added responsibility of minimizing post-traumatic sequelae by sufficient radicalism in the removal of dead brain tissue, bits of bone, and other foreign matter.

Compound depressed fractures should be operated upon as soon as the patient's condition permits. The removal of the area of depression with an old fashioned trephine followed by readjustment of the depressed pieces and replacement of button of bone is good when practicable. The dura should be inspected and if necessary, opened. When the dura is torn, it should be repaired. If torn beyond repair, the edges should be approximated and the area packed



Fig. 1. Compound depressed fracture of right forehead before repair.

Fig. 2. Compound depressed fracture of right forehead after repair. A button of bone is removed and after the remainder of the depression is elevated, the trephine button is replaced.

with some antiseptic gauze to hold the dural lining against the brain tissue. The pack is removed slowly over a period of 6 to 8 days. If the brain is lacerated, the necrotic tissue should be removed with care.

Compound fractures through the frontal sinus, cribriform plate and orbit should be operated on as soon as the patient's condition permits. (If simple, they can be treated by conservative measures). The posterior wall of the frontal sinus should be carefully inspected for fractures and depressions. Depressed and comminuted pieces should be removed. The dura should be inspected for tears and if present, they should be repaired. If torn beyond repair, the edges should be approximated and the area packed with some antiseptic gauze to hold the dural lining against the brain tissue. The pack is slowly removed over a period of 6 to 8 days.

Careful work necessitates good exposure. Good exposure in this region may mean devastating defects of the forehead. Repair of

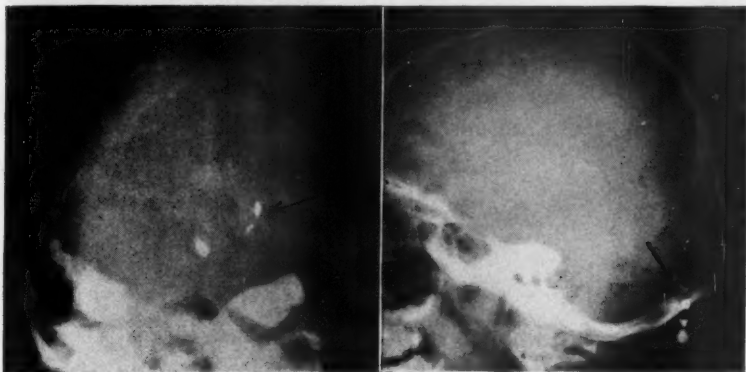


Fig. 3. Bullet wound of the occipital region causing a tear of the inferior aspect of the right lateral sinus.

Fig. 4. The sinus opening has been plugged with muscle.

the defect may be undertaken 3 to 4 months later. I prefer osteoperiosteal transplant from the outer layer of the patient's skull for repair of old skull defects. If the defect is sufficiently small, a trephine of the proper size may be used, both to freshen the inner margin of the defect, and to obtain the transplant from the outer table of the skull.

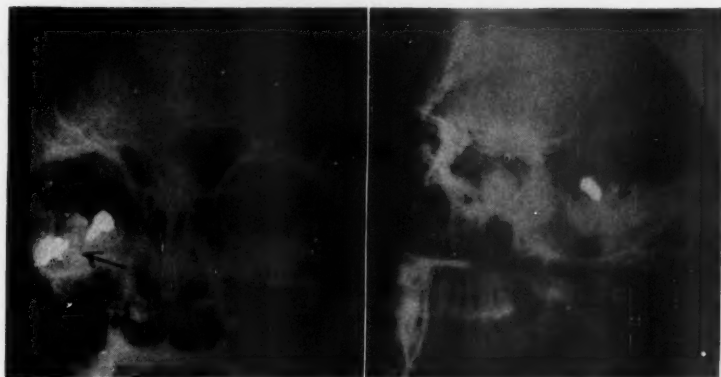
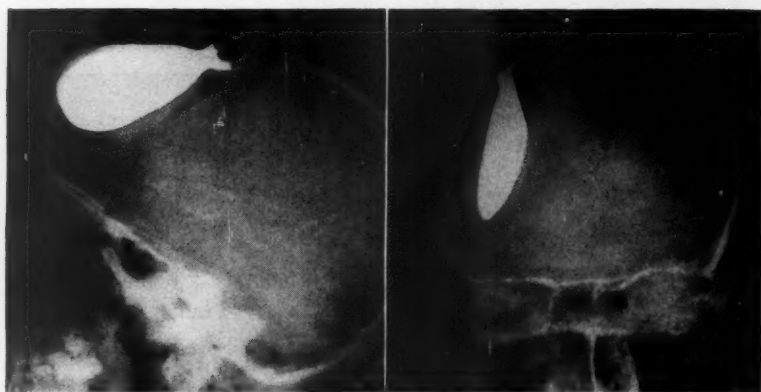


Fig. 5. Bullet wound of the right mastoid and petrous bone with cerebrospinal fluid and brain tissue discharge from right ear. Right peripheral facial paralysis.

Fig. 6. Recovery following cleansing operation.

Bullet, stab, and other penetrating wounds of the head are treated essentially in the same manner as any other compound fracture.



Figs. 7 and 8. Lateral and anterior views of fan blade injury of right frontal lobe.

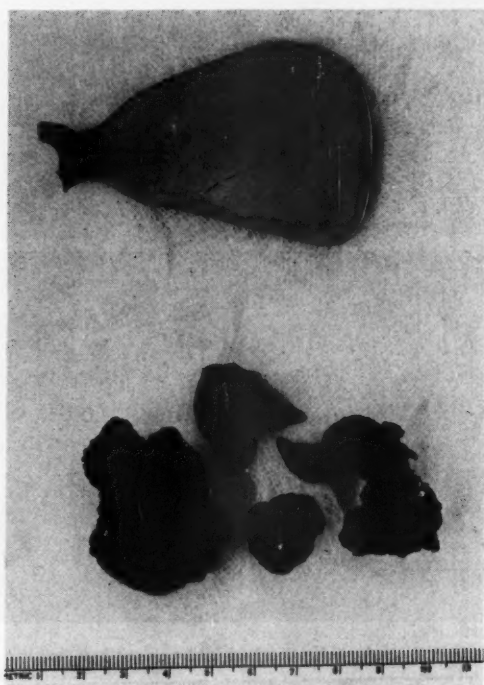


Fig. 9. The removed fan blade and intracerebral clot weighing 22 grams. See Figs. 7 and 8.

Cases of bullet wound with perforation of the skull and intracranial damage may be grouped into three classes:

1. Those who enter the hospital in a moribund state and die soon after.
2. Those who look very ill but continue long enough to develop evidences of increased intracranial pressure, increased respirations, ascending temperature and die within 24 to 36 hours.
3. Those who look good irrespective of apparent trauma.



Fig. 10. Patient's appearance 8 weeks later. Mentality seems normal. (See figs. 7, 8 and 9.)

Much can be done for the last group. Operative removal of bone fragments, bullet if easily accessible, necrotic brain tissue, are in order. The dura should be repaired, if necessary by the use of the transplanted tissue.

In stab and other penetrating wounds of the head, arterial and venous channels may be involved, the early recognition and treatment of which may save the patient's life.

In table 1, 130 cases of simple and compound depressions are analyzed. The mortality in simple depressions is much lower. The more anteriorly placed the depression, the better the immediate

outcome. Depressions in the posterior parietal and occipital regions were much more deadly than in the frontal region.

TABLE 1

Simple and Compound Depressed Fractures

Total cases	130
Deaths	20
Mortality	15.3%
Simple depressions	44
Deaths	2
Mortality	4.5%
Compound depressions	86
Deaths	18
Mortality	20.9%
Depressions occurring in	
anterior third of skull	60 cases
middle third of skull	63 cases
posterior third of skull	7 cases
Mortality for	
anterior third depression	10.3%
middle third depression	18. %
posterior third depression	28.5%

Table 1. This table is self explanatory. Mortality in simple depression is much lower than compound depressions. Depressions occurring in the anterior third of the skull afford the best mortality. More posteriorly placed depressions are more serious.

Thirty cases in the above group suffering from compound depressed fractures in the frontal sinus region are analyzed in table 2. Two-thirds had extensive dural tears. Cerebrospinal fluid rhinorrhea was seen in three cases preoperatively and one case six weeks after operation. In one case, there was brain abscess which was drained with success. Meningitis occurred in three patients with one death. Sulfonamide therapy was used to combat the meningeal infection with success.

Cerebrospinal fluid rhinorrhea is a serious complication of head injury. The possibility of intracranial infection is great. With recurrent rhinorrhea, infection may enter the cranial cavity several months or years afterward. If careful x-ray does not show evident fracture lines and particularly fragmentation of bones at the base of the skull, conservative treatment may be undertaken with greater confidence. The patient is put to bed in a semi-Fowler's position and kept there for 4 to 6 weeks. During this period he is strictly confined to his bed. He should move about in bed as little as possible. Blowing of the nose is contraindicated. Instillation of a few drops of antiseptic vasoconstrictor three times daily may be useful. In the usual case, there is cessation of discharge within 48 hours.

TABLE 2

Thirty Operated Cases of Acute Compound Depressed Fractures Through Frontal Sinus, Orbit and Cribiform Plate

Recovered	27
Died	3
1. Clinical evidences of brain injury	
Slight	6 cases
Definite	13 cases
Severe	11 cases
2. Dural tears	
Present	20 cases
Absent	10 cases
3. Complications	
Cerebrospinal rhinorrhea	4 cases
	no death
Pneumocephalus	2 cases
	no death
Brain abscess	1 case
	no death
Local infection	3 cases
	no death
Meningitis	3 cases
	1 death

Table 2. Among the compound depressions in table 1, 30 suffered from compound depressed fractures in the frontal sinus region. Two-thirds had extensive dural tears. Cerebrospinal fluid rhinorrhea was seen in four cases and pneumocephalus in two cases. Local infection occurred in three patients following repair. In one case, there was a brain abscess. Meningitis occurred in three patients with one death.

One should not be fooled by this cessation, in that among a few, the fluid may collect in the posterior nasal cavity, gravitating into the pharynx and down the esophagus. This usually causes a "tickling sensation" and a feeling of moisture in the nasal pharynx. If this persists for 6 to 8 days, or after apparent cure, patient returns with recurrent rhinorrhea, operative treatment is unquestionably indicated. In the surgical management of cerebrospinal fluid rhinorrhea, we are guided by the x-ray films, and the side on which the fluid discharge occurs. Through a frontal flap, the dura is dissected off the anterior fossa, until the tear is visualized. Repair may be effected with silk or if the tear is extensive, with fascial transplant obtained from the temporal fascia.

Pneumocephalus. We have had nine examples of pneumocephalus with two deaths and seven recoveries. The amount of air in the cranial cavity should be checked by frequent x-ray examinations. In the above group only two were operated upon. One was a compound depressed fracture of the occipital region, the other an ex-

ample of cerebrospinal fluid rhinorrhea. In both cases indication for operation was other than the air in the cranial cavity. Operative treatment for pneumocephalus perse is seldom necessary.

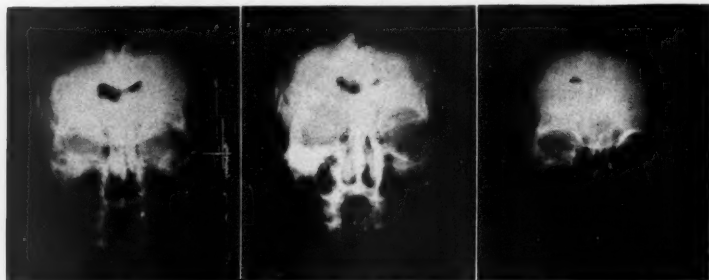


Fig. 11. Pneumocephalus due to cerebrospinal fluid otorrhea treated conservatively. Two days after accident.

Fig. 12. Pneumocephalus due to cerebrospinal fluid otorrhea treated conservatively. Three days after accident.

Fig. 13. Pneumocephalus due to cerebrospinal fluid otorrhea treated conservatively. Five days after accident.

CORRECTIVE OPERATIONS

The primary purpose of this group is to repair defects and restore deformities in order to alleviate present disabilities and prevent future ones. The repair of simple depressions and skull defects belong in this group.

Operation for simple depressed fracture, as a rule, is elective. Slight depressions in the forehead region are better left alone. Frequently, x-ray evidences of depression is not as marked as that seen at the operation. In the repair of simple depressions, an effort should be made to obviate postoperative defects. The use of an old fashioned trephine to remove a portion of the depression is suggested. After elevating the remainder of the depression, inspecting the dura, opening same if necessary, the button of bone is replaced minimizing deformities.

Repair of skull defects has already been discussed. Osteoperiosteal transplant from the patient's skull can be obtained either with a chisel or with a trephine. The latter is excellent for small defects. Autogenous transplant from the outer table of the skull is successful in most instances.

OPERATIONS PRIMARILY FOR EXPLORATION

Granted certain findings are at hand, exploration is justifiable even though the results may not be favorable. A combination of all

or some of the following signs are impressive:

1. Dulling of the conscious state leading to unconsciousness or progressive deepening of an unconscious state already present.
2. Presence of progressive localizing signs, rather than neurologic signs implicating the entire nervous system.
3. Lowering pulse rate (in some cases).
4. Increase in spinal fluid pressure (in most cases).

The pathologic entities dealt with are subdural hemorrhage, (acute and chronic), extradural hemorrhage, subdural collection of spinal fluid and massive intracerebral clot. On the basis of symptoms and signs, the location and pathology should be determined preoperatively, if possible, and this is possible in a great many of the more typical cases. However, because of similarity of symptoms and signs and conflicting neurologic findings, operative diagnostic procedures are at times necessary to determine the exact location of the lesion. In acute and subacute lesions, air studies alone are dangerous and at times they are misleading because of localized areas of cerebral edema. A combination of exploratory trephination followed, if necessary, by encephalography has been most helpful. The trephine openings are made at the frontoparietal junction 2 inches on either side of the midline, if subdural hemorrhage is suspected. In the absence of positive findings, encephalography, rather than many other openings in the skull will clarify the picture.

Middle meningeal hemorrhage. On the whole, the diagnosis of middle meningeal hemorrhage is based on the presence of markedly dilated pupil or an extraocular palsy on the affected side with evidence of contralateral paralysis. In the typical case, there may be a lucid interval and usually cases of middle meningeal hemorrhage do not look very ill, certainly early in the progress of the disease. The presence of slightly bloody spinal fluid, if a lumbar puncture has been performed, should not deter operative intervention in that all cases of middle meningeal hemorrhage punctured, in this series, showed bloody spinal fluid. In such cases (because of the presence of blood in the spinal fluid) to blame it all on subarachnoid hemorrhage with concomitant increased intracranial pressure as an explanation for the clinical findings, is a grave mistake. Cases of extradural hemorrhage can be diagnosed on clinical grounds for a majority manifest typical symptoms and signs. Only occasionally air studies are justifiable.

In table 3, 21 operated cases of middle meningeal hemorrhage are analyzed. Lucid interval was seen infrequently. Dilated pupil on the side of the lesion was frequent. Focal signs implicating the

TABLE 3

Twenty-One Operated Cases of Middle Meningeal Hemorrhage

State of consciousness	
Lucid interval	6
Unconscious throughout	10
Drowsy and disoriented	5
Pupils	
Larger on same side	17
Larger on opposite side	1
Equal	3
Extraocular palsy	
Third	4
Fourth	1
Sixth	1
Focal Signs	
Present	18
Not present	3
Vital functions	
Pulse	45-60
Respirations	18-26
Temperature	100-102
Spinal fluid findings	
Pressure	45-650
Bloody	in all nine cases punctured
Results	
Recovered	15
Died	6

Table 3. Lucid interval was seen in less than a third of the cases. Dilated pupil on the same side as the lesion was common. Focal signs implicating the motor centers were present in all but three. Patient's respiration and temperature were but slightly elevated. The pulse rate was frequently depressed. The spinal fluid pressure was frequently high, (over 250), but in one case it was 45 mms of water. The fluid was bloody in all punctured cases. Bloody spinal fluid does not rule out epidural hemorrhage.

motor cortex were observed in the majority. In the beginning of the condition, the pulse rate was uniformly low. Spinal fluid pressure in these cases showed wide variations. As a rule, the pressure was high. The punctured cases yielded bloody spinal fluid.

Operation of choice for extradural hemorrhage of middle meningeal origin is subtemporal decompression on the side of the lesion. If the clot is beyond the confines of a temporal muscle and fascia a small bone flap may be turned.

Patients with *acute subdural hemorrhage* almost always look very ill. In a great many, progressive localizing signs are evident. Both sides are always explored and in some cases, with the help of encephalography, the presence of unusual localization of a subdural clot may be determined. In one instance, an interhemispheric clot

was proven by this method. The spinal fluid is practically always bloody and its pressure may or may not be elevated. If, on careful observation, the patient displays localizing signs not previously noted, with slow but progressively increasing coma, then he should be explored.

TABLE 4

Acute Subdural Hemorrhage

Total cases	24
Deaths	11
Lucid interval	4
Continued unconsciousness with disorientation	14
Dilated pupil	9
Hemiparesis or hemiplegia	13
Dilated pupil with contralateral paralysis or paresis	8
Convulsions (Jacksonian)	4
Convulsions (generalized)	2

Table 4. Note that lucid interval was present in this group. Dilated pupil with contralateral paralysis—a syndrome seen with epidural hemorrhage—was present in a third of the cases. Patients with acute subdural hemorrhage appear much more seriously injured than those with epidural hemorrhage, certainly early in the disease.

Among 24 cases with acute subdural hemorrhage, there were 11 deaths. Three cases had bilateral subdural hemorrhage. Of these, one recovered. The indications for operation in this group are listed in table 4. Dilated pupil with contralateral paralysis or paresis, a picture which is seen in middle meningeal hemorrhage, was present in 8 out of 24 cases. Convulsions were noted among six cases.

Operation of choice in acute subdural hemorrhage is bilateral trephination and subtemporal decompression on the side of the lesion.

Subacute and chronic subdural hematoma may or may not show localizing signs. Headache is characteristic and it is frequently lateralized to the side of the lesion. Frequently, the patient slowly slips into an unconscious state, but occasional remissions occur. The spinal fluid pressure is often high and may be bloody or xanthochromic. Depending upon the case, encephalography or ventriculography may be justifiable or bilateral trephination may be selected. Subdural hematoma may coexist with serious head injury with brain damage (as a rule, it follows minor injuries). This association may cause long periods of unconsciousness and disorientation. Frequent neurologic examination and, if necessary, air studies are in order, in such cases.

TABLE 5

Thirty-One Operated Cases of Chronic Subdural Hematoma (Adult)

	Recovered	30
	Died	1
Headaches		
Present		26 cases
Were not complained of or no history		5 cases
Pupils		
Dilated on side of lesion		8 cases
Equal		23 cases
Extraocular palsy		
Third		3 cases
None		28 cases
Fracture of skull		
Present		12 cases
None		19 cases
Side involved		
Left		16 cases
Right		14 cases
Bilateral		1 case
Spinal fluid findings		
Pressure above 300		23 cases
200-300		2 cases
Bloody or xanthochromatic		12 cases
Operation of choice:		
Bilateral exploratory trephine subtemporal decompression		
on the side of lesion or osteoplastic flap if clot is solid.		

Table 5. Note that occasionally there may be no history of headache. Inequality of pupil was seen in one-fourth of the cases. There was associated fracture of the skull in twelve out of thirty-one cases. Spinal fluid pressure was high in most instances.

In table 5, 31 cases of chronic subdural hematoma are analyzed. Of these, three were of the more solid variety. Headache was frequent, and characteristically on the side of the lesion. A dilated pupil occurred in 8 out of 31 cases and it was on the side of the lesion in each instance. Third nerve paralysis was seen in 3 cases, always on the side of the lesion. Fracture of the skull was present in 12 out of 31 cases. Bilateral subdural hematoma was seen only once but the left and the right sides were about equally represented in unilateral lesion. Spinal fluid pressure was high in the majority. It was xanthochromic or bloody in 12 out of 31 cases.

Operation of choice in subacute and chronic hematoma is bilateral trephination with subtemporal decompression on the side of the lesion, if the clot is mostly fluid. If the clot is solid, removal through an osteoperiosteal flap is preferable.

Subdural accumulation of spinal fluid may simulate subdural and extradural hematoma as concerns signs and symptoms. It is, almost always, more slow in its onset and becomes evident several days after the accident. Frequently the case is diagnosed as a subdural hematoma suspect and on exploration this curious accumulation of spinal fluid is found in the subdural space. That there may be associated lesions elsewhere in the brain, should always be kept in mind. It is a good practice to obtain encephalograms following the drainage of subdural accumulation of spinal fluid in order to rule out the presence of other operative conditions. That in some cases a cause and effect relationship does exist between this pathologic

TABLE 6
Subdural Collection of Spinal Fluid

Total cases	18
Deaths	7
Lucid interval	2
Continued unconsciousness with disorientation	7
Dilated pupil	6
Hemiparesis or hemiplegia	6
Dilated pupil with contralateral paralysis or paresis	4
Convulsions (Jacksonian)	2
Convulsions (generalized)	0

Table 6. Hardly ever a diagnosis of subdural collection of spinal fluid is made before operation. These cases show signs and symptoms similar to those with epidural and subdural hemorrhage. The association of other pathologic changes should ever be suspected. When in doubt, air studies should be made to rule in or out co-existent pathology.

condition and the patient's symptoms is well proven by the rather miraculous cures following drainage, in some cases.

Eighteen cases in the operative group were found to have varying amounts of subdural collection of spinal fluid. Seven deaths in the group suggests the possibility of coexistent lesions elsewhere in the nervous system. The indications for operation are listed in table 6. This condition mimics epidural and subdural hemorrhage but may coexist with such pathology.

Massive intracerebral clot due to trauma is very infrequent. We have had two examples occurring in the temporosphenoidal lobe with signs suggesting such localization. In the autopsy group of 158 cases, there was only one example of massive intracerebral clot, occurring near the basal ganglia.

Because of signs and symptoms, exploration was effected in some cases only to find edema, cerebral bruises, contusions and lacerations.

If an accurate preoperative diagnosis of such lesions were possible, they would be treated conservatively, but because in some cases of extradural and subdural hematoma there are similar findings and the patient, on operation, makes excellent recovery, these mismanagements are in part justified. The absolute necessity of frequent neurologic check-ups and evaluation of changes noted, cannot be over-emphasized. I am convinced that many cases can be saved by this timely intervention.

TABLE 7

In Twenty-Five Cases the Following Signs and Symptoms Led to Exploration But the Latter Revealed No Massive Clots. Usually Edema of the Brain, Contusions and Subarachnoid Hemorrhage Were Seen.

Total cases	25
Deaths	13
Dilated pupil	9
Hemiparesis or hemiplegia	12
Lucid interval	5
Continued unconscious or disorientation	20
Dilated pupil with contralateral paralysis	7
Convulsions (Jacksonian)	4
Convulsions (generalized)	2

Table 7. This table is self explanatory. If it were possible to be sure of the exact diagnosis preoperatively, these patients would not have been operated upon. However, their signs and symptoms were very similar to those with epidural and subdural hemorrhage.

In table 7, 25 operative cases are analyzed in which edema of the brain, contusions and subarachnoid hemorrhage were seen. The indications for operation were similar to those seen with meningeal hemorrhage. It is of interest to point out that dilated pupil with contralateral paralysis may be seen not only with meningeal hemorrhage but also with subdural collection of spinal fluid, edema, subarachnoid hemorrhage, and cerebral contusions.

OPERATIONS PRIMARILY FOR COMPLICATIONS

Under complications of head injury in which operative intervention may be indicated, are grouped the following conditions:

1. Optic nerve dysfunction;
2. Facial paralysis;
3. Various conditions due to infection, namely otitis media, mastoiditis, brain abscess and osteomyelitis of the skull.

Optic nerve dysfunction. Although post-traumatic blindness may be due to intraocular involvement, a perfectly normal looking eyeball including fundus is occasionally seen with complete blindness following head injury. We have seen seven such examples.

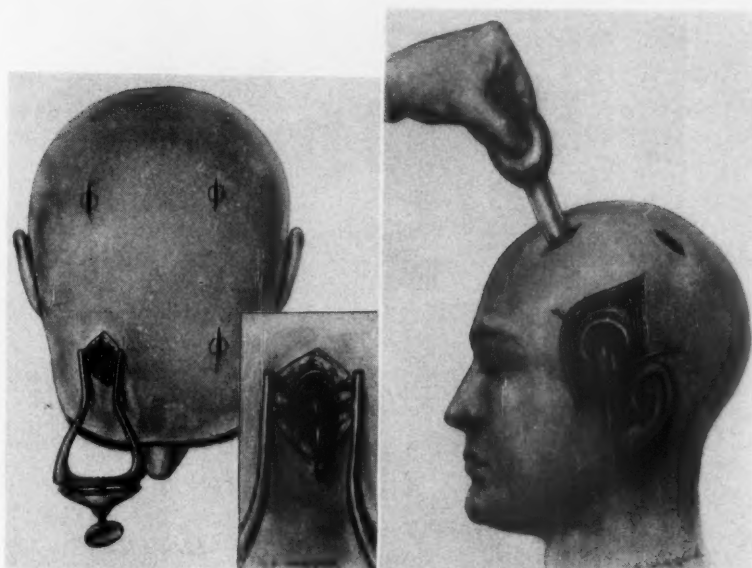


Fig. 14. Common operative approaches in head injury: (1) multiple bilateral trephination.

Fig. 15. Common operative approaches in head injury: (2) trephine openings and subtemporal decompression on the same side for evacuation of subdural hematoma.

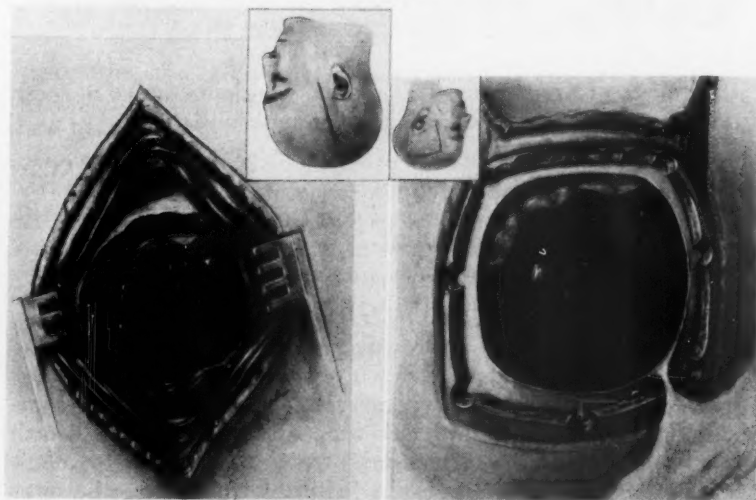


Fig. 16. Common operative approaches in head injury: (3) subtemporal decompression for evacuation of extradural hemorrhage.

Fig. 17. Common operative approaches in head injury: (4) osteoplastic flap for solid chronic hematoma.



Fig. 18. Epidural clot weighing 69 Gm. and removed 62 hours after injury. There was no lucid interval. Patient showed increasing coma and right hemiplegia. Recovery.

The mode of production of non-functioning optic nerve in these cases is at times difficult to explain. The possibilities are:

1. Gross severance of the optic nerve;
2. Hemorrhages in its sheath with pressure neuritis;
3. Microscopic destruction of the continuity of neural channels with the nerve externally appearing quite normal;
4. Destruction of blood supply to the retina.

These may be brought about by fracture about the optic foramen, depression in this region or crowding of optic nerve against bone in contrecoup lesions with no fracture or depression. In cases of blindness following head injury, careful x-ray examination to show the optic foramen and the lesser wing of the sphenoid is worth while to detect possible depressions. Particularly if the patient's condition permits I feel that it is justifiable to explore the optic nerve and in the presence of corrigible pathologic findings, effect a restitution. Adson has described a case with partial involvement of the optic nerve due to an area of depression in the optic foramen

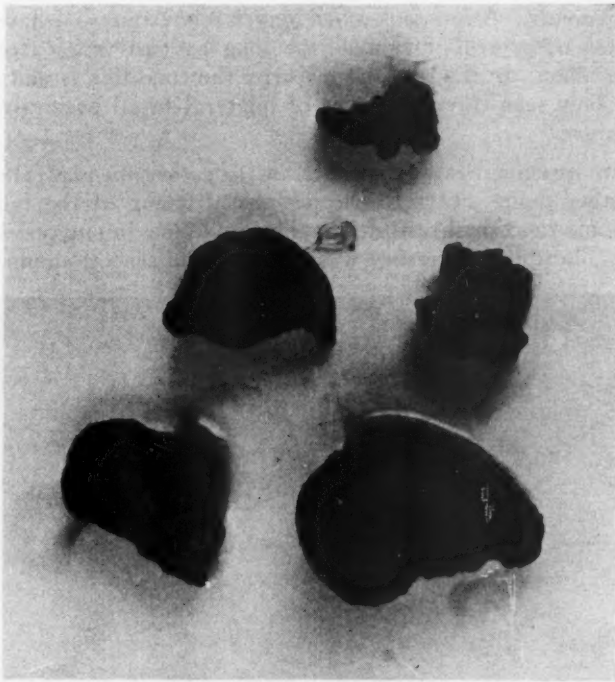


Fig. 19. Massive epidural (middle meningeal) clot in a case of simple depressed fracture associated with increasing stupor.

region with cure following a decompression. In two cases at autopsy we have seen a complete tearing of the optic nerve following a severe head injury. We have operated on two cases with complete blindness following head injury. In one there was a pulseless, badly held down ophthalmic artery which was liberated with some return of circulation. Light perception returned in this case. In the other, the optic nerve looked normal for all intents and purposes. It seems evident that a great deal more can be done in cases of partial involvement of visual field than in those where there is complete blindness.

Peripheral facial paralysis. Facial paralysis following head injury is a frequent complication and particularly is it to be seen in cases with bleeding from the ear. In the greatest majority the nerve is injured in the facial canal, in close proximity to the geniculate ganglion. This is proven by the presence of loss of sensation of taste in the anterior two-thirds of the tongue of the affected side.

In a good many, peripheral facial paralysis seen following a head injury is of good prognosis. Over 80 per cent recover within two

to four months. A few took much longer for recovery. I have seen evidences of return of function as long as two years after the initial trauma. In the greatest majority the condition is unilateral. I have only seen three examples of bilateral facial paralysis after head injury.

In an occasional case it is necessary to suture the central stump of another motor nerve to the peripheral stump of the facial to effect some functional restitution. This was done in one case in this series. The spinal accessory was used for the central stump. The

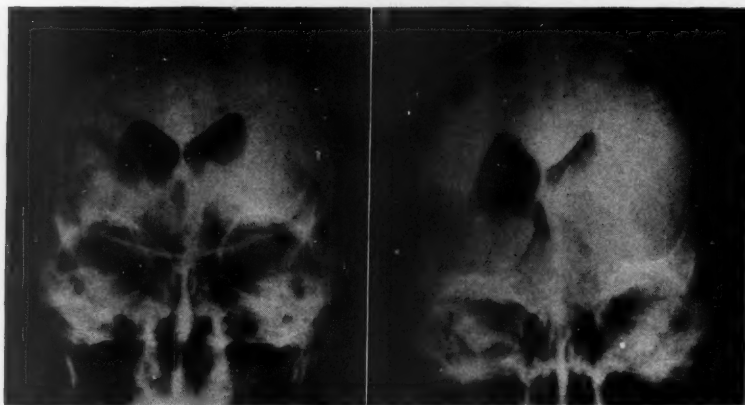


Fig. 20. Encephalogram on the left side was obtained 14 months after bilateral trephination. At that time diagnosis of left traumatic subdural accumulation of spinal fluid was made. There is beginning thinning of left lateral ventricle.

Fig. 21. The encephalogram to the right was obtained 12 months after the first group. Here can be noted a marked shifting of the left lateral ventricle and third ventricle due to an extensive infiltrating tumor of the fronto-parietal region. At times subdural accumulation of spinal fluid is a hazardous diagnosis to make.

results are good for recovery of tone and volitional innervation to the facial musculature but emotional innervation does not return in the majority. Operations designed to decompress the nerve in the facial canal are not justifiable in the greatest majority, for recovery obtains very soon.

Ear infection. In a previous communication I have discussed ear infection in cases of head injury with bleeding from the ear. Otitis media is uncommon because of the treatment used nowadays, i.e., leaving the ear alone in the presence of bloody discharge from same. There is one situation where there is justification for intervention. In the presence of chronic ear infection a fracture line extending into the mastoid area is a potential avenue for intracranial introduction of infection. In such a case a prophylactic drainage may

be justifiable on grounds that it will afford external drainage of infection. Otherwise, cases of bleeding from the ear are left alone unless there are certain evidences pointing to the necessity of treatment.

Early mastoid infection in head injury is seen occasionally. Mastoiditis appearing several weeks after injury is seen more frequently. In the presence of mastoid infection, the treatment of same is based upon the usual criteria governing such treatment in general.

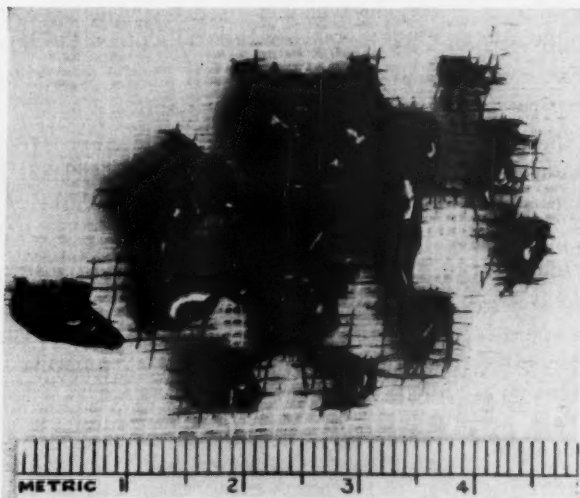


Fig. 22. Massive clot from left temporo sphenoidal lobe. Increasing stupor with paresis of right lower face and right upper limbs. Recovery.

Osteomyelitis of the skull. This is a rare complication. We have had only six cases of osteomyelitis of the skull due to head injury. The rarity of this complication in cases of head injury is also brought out by Rand. The treatment is very satisfactory and depends for its success on the entire removal of the diseased area of bone followed by drainage. The proper care of compound fractures should obviate the occurrence of osteomyelitis of the skull.

Brain abscess. The treatment of brain abscess in head injury is essentially the same as brain abscess of other etiology. Usually it is of the extension type hence, localized to only one area of the brain, making the possibility of recovery somewhat better. With hematogenous etiology, involvement of the brain is frequently multiple. Drainage of the abscess cavity is appropriate.

OPERATIONS PRIMARILY FOR DECOMPRESSION

Operations primarily for decompression are not desirable. Where there are signs and symptoms justifying exploration operative intervention is perfectly proper. Too much conservatism would tend to allow the exitus of many a patient who possesses a corrigible lesion. Although decompressions would "catch" most of these cases, it is felt that careful and repeated examinations would catch these same cases on a more accurate and scientific basis. Routine decompressions not based on actual data may miss trouble which can be rectified. It must be very discouraging to do a routine decompression on the right side and find a large extradural clot on the left side at autopsy.

SUMMARY AND CONCLUSIONS

1. In the management of depressed fractures some preoperative forethought will obviate severe postoperative defects. The trephine method can be used advantageously in most cases.

2. In penetrating wounds of the head, the possibility of tear of venous and arterial channels with consequent massive intracranial hemorrhage should be kept in mind.

3. Preoperative diagnosis of the type of intracranial hemorrhage is possible in the more typical cases but it must be emphasized that at times the signs and symptoms of epidural, subdural, intracerebral hemorrhage and subdural collection of spinal fluid may be practically identical.

4. Exploration for intracranial hemorrhage is justifiable given certain symptoms and signs. These are, first, dimming of the conscious state or increasing coma in an already unconscious patient; second, the appearance of neurologic signs not previously seen. The progression of such localizing signs. Third; in some cases, lowering pulse rate; fourth, in most cases increase in the spinal fluid pressure. Frequent examinations for localizing signs are essential.

5. Exploration for subdural hemorrhage should consist of bilateral trephination at the frontoparietal junction about 2 inches on either side of the midline. If these are negative, air studies are justifiable.

6. Subdural collection of spinal fluid is certainly the cause of signs and symptoms in some cases, but it may co-exist with other intracranial lesions. It is a hazardous diagnosis to make and when in doubt, co-existent lesions should be ruled out by air studies.

SULFANILAMIDE IN THE LOCAL TREATMENT OF TRAUMATIC WOUNDS

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THE experience in the present World War,¹ plus the increasing number of casualties from modern transportation farm and industrial accidents, have led to a clearer conception of the treatment of compound wounds. Studies made on the species of microorganisms found in wounds in the Army zone and in hospitals evacuated for war purposes during the last war and the present war, have been comparable. Thirty-two per cent of the wounds harbored three kinds of organisms. Nineteen per cent, single species; 19 per cent four species; 23 per cent five or six species; 7 per cent were sterile. The species most generally found were, staphylococci (85 per cent), Friedlander's bacillus, *B. Welchii*, streptococci, the colon group, and *B. pyocyaneus*. All compound wounds are potentially infected and should be regarded as so until proven otherwise. Too often first aid treatment is inadequate and is responsible for unnecessary secondary trauma. The man who attends the case the first eight to ten hours, often determines the success or failure of the treatment.

Jenson, Johnsrud and Nelson² reported the use of sulfanilamide in compound fractures in July, 1939. They were able to reduce the incidents of infection from 27 to 5 per cent. In a previous series of 94 compound fractures, in which debridement, irrigation and careful hemostasis were carried out, 27 per cent became infected, there were seven cases of gas gangrene and five amputations to control infection. In forty-one compound fractures treated by the usual method, plus the implantation of from 5 to 15 Gm. of sulfanilamide crystals and primary closure of the wound, there was an incidence of 5 per cent infection. Sulfanilamide crystals buried in a wound dissolve slowly and find their way into the general circulation over a period of many hours. During this time, the serum, hematoma and local tissues of the wound are saturated with the drug and by using a sufficient amount in the wound, a concentration of 800 mg. per cent should be maintained for a considerable time. Systemic medication with sulfanilamide attains only a 10 to 20 mg. per cent in the blood. The concentration attained by the local implantation is bactericidal for organisms more susceptible to sulfanilamide and bacteriostatic for *Staphylococcus aureus*, and Welch's bacillus; however if the number of staphylococci or Welch's bacilli is relatively large, infection may occur. The drug is acting

¹Presented before the Louisville Surgical Society, Feb. 7, 1941.

in a medium which is favorable to the growth of the bacteria and is unfavorable to the action of the drug, because tissues break down into a peptone-like substance; yet since the drug exerts a neutralizing effect on the toxins of both staphylococci and Welch's bacilli, the amount of tissue breakdown is limited by the drug. Since the drug converts bacteria into a static or non-pathogenic phase in which they do not invade the surrounding tissues and do not multiply, these bacteria are taken care of by the normal clearing mechanism of the animal and are destroyed.

Key and Burford³ experimented with rabbits producing bilateral symmetrical fractures in one bone of each foreleg. The wound in one leg was packed with crystals of sulfanilamide and the other leg served as a control. The animals were sacrificed at periods of 5 to 56 days after the fractures. The bones of the forelegs were removed and compared grossly as to the amount of callus and the firmness of the union of the fracture. There was no noticeable difference between the two. X-ray studies of the legs revealed minor difference in the amount of callus present, but were not sufficiently marked to be of importance, nor did they favor either the sulfanilamide or the control legs. Microscopic studies were then made and there was no important or constant differences in the degree or manner of bone formation present in the two legs. They concluded that the local implantation of sulfanilamide crystals did not interfere with the union of the soft tissues or of the bone. In further experiments by the same authors,⁴ on operative wounds in muscle, subcutaneous tissue and joints of dogs, using the opposite leg as a control, relative large amounts of sulfanilamide powder was placed before the wounds were sutured. The animals were killed at intervals so that the experimental wounds were from 1 to 15 days duration. Gross and microscopic examination revealed no constant difference in healing between those containing sulfanilamide and those which did not. There was, however, a tendency to excess collection of fluid in the early wounds. The wound in muscles, fascia and subcutaneous tissue treated by sulfanilamide, appeared to heal at about the same rate as the control wounds. The joints of the dogs showed a low-grade inflammatory reaction which tended to disappear with a return to approximately normal condition by the tenth or twelfth day. This reaction was no more marked in the wounds which contained the sulfanilamide than it was in those which did not. There was no evidence in any of the animals that the sulfanilamide in the joint had any deleterious effect on the articular cartilage.

Bricker and Graham⁵ experimenting with dogs in which sulfanila

mide was given in doses comparable to those used in human beings, found it has an inhibitory effect on the healing of uninfected incised wounds.

Campbell and Smith⁶ concluded from their work with sulfanilamide, in different types of fractures, that the evidence did not prove definitely that the drug is or is not a preventive of infection in compound fractures. They felt that a comparative analysis of at least 200 cases, with a control group of an equal number of analogous cases from past records, should be run. Also that primary healing of mild, fresh compound fractures, should be disregarded as evidence of any favorable action of sulfanilamide. In the severe and moderate types of compound fractures reported herein, certainly better anatomic and functional results were secured by internal fixation in conjunction with sulfanilamide, without higher proportions of complications, than developed in comparable control groups wherein internal fixation and sulfanilamide were not employed. In seven consecutive cases with potential infection following compound fractures, extensive surgery was followed by more complete restoration of anatomic contour, without relighting of infection, than had been possible in the past. They also concluded that the beneficial influence of this drug was most striking in the group of actively infected fractures in which radical surgery had previously led to disaster.

Far too many premature conclusions regarding the beneficial action of bactericidal agents are to be found in the literature. The present impression of sulfanilamide is favorable, but more extensive investigation must be carried out, not only with sulfanilamide, but with other chemotherapeutic agents, before an accurate evaluation is possible.

There is an increasing number of articles appearing in the literature on both clinical and experimental work with the local use of this drug. The majority of these reports have been very favorable, and probably some of them have been too enthusiastic; however from the information at hand, and from my own limited experience, from the clinical use of sulfanilamide crystals, I feel that we have a very valuable aid in the prevention of serious infection in practically all types of open wounds.

Compound wounds should be thoroughly cleansed as the initial step in their treatment. The skin about the wound should be scrubbed with green soap and washed with a flow of warm sterile water, the wound being protected during this procedure. Next the wound itself is superficially scrubbed and irrigated with water or normal saline and the area draped in the usual manner. The wound

should be thoroughly debrided and all devitalized tissue removed. In some cases it may be necessary to enlarge the external wound to accomplish this, and any foreign material carried into the wound should be removed. In compound fractures, clothing or dirt may easily be carried in. Such deep wounds should be well irrigated, allowing the point of the irrigator to be inserted into the wound so as to allow the stream of saline to flow from within out, rather than to spray over and into the wound. Any soiled pieces of bone detached from its periosteum, should be removed, as they are sources of infection and the latter may act as a foreign body. Bleeding should be thoroughly controlled and strong antiseptics should not be poured into the wound as this devitalizes fresh tissue and makes an excellent medium for bacterial invasion. Two to fifteen grams of sulfanilamide crystals, depending on the size of the wound, are then sprinkled throughout the wound. If the case is treated within the first eight to ten hours following the accident, the wound may be loosely closed with interrupted sutures. Care should be taken to avoid tension by sutures, and this can often be avoided by small counter incisions. If there is some doubt as to the viability of the skin flaps, sutures may be placed and tied several days later. Wounds with large defects, and grossly contaminated wounds, should not be closed by primary suture, but packed open with vaseline gauze. Should one's judgment with regard to primary closure be wrong, and infection develop, it can be recognized by the physical and clinical symptoms and examination of the wound. The sutures should be removed, the wound opened wide and packed with vaseline gauze. All severe traumatic wounds should be splinted, all fractures completely reduced and thoroughly immobilized, for the comfort of the patient, to cut down motion and irritation of the wound. Sulfanilamide crystals may be obtained in sterile ampules or in bulk and sterilized by autoclave.

During the last fifteen months, I have used sulfanilamide crystals in compound wounds that have involved the skin, subcutaneous tissue, muscle, fascia, tendons, bones and joints. I feel that there has been practically no irritation to any of these structures, and possibly, with the exception of the skin, no delay in union. When the drug is placed in the skin, a firm crust forms, which possibly delays somewhat its healing. I have had no major infections, and the minor infections have been greatly reduced. In operative bone work, the local use of sulfanilamide crystals decreases rather markedly the chances of infection. I do not wish to offer sulfanilamide as the panacea for all traumatic wounds. A little of the drug sprinkled indiscriminately here and there will not prevent infection,

unless the underlying principles of thorough cleansing and debridement, and good surgical judgment are exercised. This is to be found in the man, rather than in the drug.

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THE ROLE OF THE FASCIA IN LOW BACK PAIN

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THE problem of low back pain continues to perplex most physicians. Many methods for the differentiation between disturbances of lumbosacral and sacroiliac joints have been devised and taught but the accepted methods are often inadequate and inaccurate in their location.

The difficulty of arriving at an accurate diagnosis is the result of a variety of factors. Anything which disturbs the mechanical function of the lower part of the back may cause a somewhat similar group of signs and symptoms. Besides, the source of pain does not always correspond to the area of which the patient complains. Moreover, it is necessary to differentiate, in each patient, between primary and secondary causes of pain, and to evaluate them properly in order to carry out efficient therapeutic measures. Structural changes may be of significance as the cause of discomfort and instability, but congenital anomalies can usually be considered only as predisposing factors.

This discussion is limited to a consideration of those structures of the lower part of the back commonly spoken of as the soft tissues, and made up of those fascial structures, muscles, and ligaments which aid in maintaining the upright posture in man. Similar symptoms may be caused by the various neurologic and skeletal disturbances, but for the sake of brevity they will be eliminated from this discussion except where they are associated with fascial changes.

The anatomy of the lower part of the back, as it affects this problem, shows a powerful group of extensor muscles, which extend from the lower part of the chest to the pelvis. The sacrospinalis muscles under consideration are associated closely in their lower insertions with the pelvic origin of the muscles of the hips and thighs at their various bony attachments. These are ligamentous attachments, usually with a wide base on the posterior wing of the ilium. They are very firmly adherent over the posterior-superior spine where the bone is roughened and irregular. Small nerves and blood vessels penetrate both the bone and fascia in this area. The lateral fascia of the thigh, fascia lata, separates slightly above the trochanter to provide a thin sheath for the gluteus maximus muscle. This muscle attaches to the fascia posteriorly while its upper anterior attachment is to the tensor fasciae latae. Extending downward below the trochanter as a broad, fibroelastic band, the fascia lata provides a

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lateral protective sheath for the muscles of the thigh as well as a supporting structure to the lower extremity.

As has been previously pointed out by Steindler and Luck,¹ the nerve supply to soft tissues arises from the posterior division of the lumbosacral portion of the spinal nerves. This structure includes all posterior ligaments, the aponeuroses, and periosteal attachments, and a portion of the gluteal fascia.

The small nerves can be seen extending obliquely downward over the brim of the pelvis both posteriorly and laterally. The lateral and posterior cutaneous nerves of the thigh are overlapped in this same region. The area to which pain is most often referred corresponds to the limits of innervation supplied by these nerves.

In the course of the evolutionary process, the assumption of the erect posture has caused the extensor muscles of the human back to become overdeveloped. In many individuals this overdevelopment has continued with contracture and increase in the lumbar lordosis. This situation occurs at the expense of the anterior muscles of the trunk, and is usually associated with a contracture of the anterior muscles of the thigh, and often with a relaxation of the muscles of the buttock and posterior thigh, and mechanical instability at the lumbosacral joint. Also, an individual with a fixed lumbar lordosis, although he shows well constructed joints and good muscle tone, may show shortening and contracture of the muscles and fascia of the anterolateral aspect of the thighs. Only when the muscles and ligaments are properly balanced and of sufficient tone to maintain a good posture without fatigue is a patient free from some of these complaints. When the fascia and muscles are in spasm or have developed contractures, restriction of motion is usually evident; and localized or generalized tenderness to palpation, if present, is a significant physical finding. Contracture of a ligament or fascia under prolonged tension will cause pain at its periosteal attachment, as demonstrated in foot strain and "tennis elbow."

Attention was first focused on this possible explanation of some of the causes of low back pain by Heyman,² in 1934, in his discussion of the relief of pain in two patients. Shortly thereafter, Ober³ demonstrated the importance of contractures of the fascia lata as one of the causes of the so-called sciatic distribution of pain. Steindler and Luck,¹ in 1938, proposed and demonstrated the vertical distribution of the nerves of the lower part of the back in association with low back lesions. They also demonstrated that localized peripheral lesions could produce radiation of pain in both the posterior and anterior divisions of the spinal nerves. By the

use of procaine injections into these superficial areas they were able to obliterate both local and referred pain, thus indicating one of the differentiating points in the study of this condition. For its relief, operations have been proposed.

The procedure proposed by Heyman⁴ consisted in severing and stripping the attachment of the gluteus maximus muscle and its associated structures from the posterior-superior spine of the pelvis. Ober's⁵ operation involved transverse section of the fascia lata between the anterior-superior spine of the pelvis and the trochanter of the femur. By means of both procedures relaxation of the lateral, gluteal, and lumbodorsal fascia is obtained.

The large majority of patients with this condition are seen as a result of minor injuries which have caused strains and sprains of the periosteal tendinous attachments low in the back. In their study, immediate biopsy has rarely been done, and later biopsies have failed, except in a few instances, to demonstrate any definite pathologic changes. The complaints themselves are often transitory, and do not recur over long periods of time. In cases of trauma, pain and tenderness usually involve the nearest structure which is put under strain, and in the postural and arthritic groups the first structure to give under continued stress and strain is usually the one involved. All these lesions may produce pain referred through the posterior and anterior divisions of the spinal nerves, as well as localized tenderness. The point of tenderness is usually so sharply localized that its presence is of significance. Since local irritation at the site of the periosteal attachment or shortening of the fascia are considered to be causes of pain, when these structures are passively stretched or contract against resistance, tension is produced which causes pain. In the so-called straight-leg-raising test the long muscles of the back and muscles of the buttock are placed under a stretch, thus accounting for the presence of this sign in this condition. In the great majority of cases there is no proof of direct pressure upon the sciatic nerve but there is fairly conclusive proof of reflex origin and distribution of pain.

When a patient presents himself with a complaint of low back pain a complete history is necessary. It is of significance to learn the exact onset of pain and as to whether it was associated with trauma, and, if so, its nature. If the pain has been present over a long period of time without history of previous injury, a discussion is advisable as to the type of work which the patient does, the position in which he does it, whether the pain is constant or intermittent, and whether there are any particular movements with which the pain is associated. Moreover, the site at which the pain first

occurred, the points of radiation, the position in which relief may be obtained, and positions of standing, sitting, and lying down—all are of importance as an indication of which structures he is in the habit of relaxing in order to obtain relief. Also, a general statement is necessary as to the patient's health otherwise, since there is always the possibility of infection, arthritis, or associated disease.

The physical examination of such a patient should be a complete one, with special attention to the back and lower extremities. The general examination is necessary definitely to rule out associated diseases, foci of infection, etc. In a study of the lower back, the posture is of importance as well as the degree of flexibility of the lumbosacral joints, spine, and hips. Evidences of contracture may be manifest by an exaggerated lordosis or flattening of the lumbar spine. The former may be associated with increased forward inclination of the pelvis and contracture of the fascia of the anterior thighs. Localized points of tenderness and the extent of radiation of pain should be taken carefully into consideration. The Ely and Ober tests, if positive, are partially indicative of anterior contractures. The extent of motion in the straight-leg-raising test is also of significance. In performing all of these examinations, the area to which pain is referred should be constantly noted. Sometimes the fascia can be felt as a tense structure beneath the skin, and often muscle spasm is constant in one particular group. In order to rule out primary sources responsible for this condition an x-ray is necessary. Its importance is of chief value in disturbances of the lumbosacral and sacroiliac joints, and those caused by arthritis. If, on examination, abnormal neurologic symptoms and signs are present, a lumbar puncture with a study of the spinal fluid should be made. In those patients who show a localized area of tenderness the so-called procaine test is usually carried out. If the test is positive—fulfilling the postulates that the needle into this area aggravates both the local pain and the radiation, and that its injection relieves the local pain, the radiation, and the leg signs—the fact is of extreme significance.

Excluding fractures, tuberculosis, etc., this study includes 432 patients who have personally been examined and whose primary complaint was pain low in the back. Of these, 201 have been excluded as due to causes other than those under consideration. Of those showing some evidence of involvement of the fascia there were 75 which were associated with arthritis in some degree. Evidence of postural changes was shown by 62, of which by far the greatest number involved changes in the lumbosacral joint. There were 7 patients in whom the diagnosis of prolapse of the interver-

tebral disc was made, and 2 with hypertrophy of the ligamentum flavum. There were 85 cases in which the involvement was primarily in the soft structures of the lower back. Of these, 25 were regarded as acute; 46, as chronic; 14 were not treated either because they were sent only for examination or because of inability on the part of the patient to undergo treatment at the time. Of those that were treated 15 were benefited by exercises, heat, and massage alone; 20 necessitated manipulation either independently or in addition to physical therapy to obtain relief, and 36 required repeated injections. In the treatment of these cases 109 local injections were given: novocain, 76; zylocain, 17; eucapin, 6; serapin, 10. The remaining 18 cases were treated by fasciotomy.

During the past three years, the acute cases which seemed to present only muscle or fascial involvement have been kept more or less mobile. They have been treated as similar to sprains elsewhere, specially of the ankle joint, on the assumption that there may be a tear in the periosteum or at least an effusion, and that, therefore, the injection of novocain into this area, with its relief of pain and alteration in sensation, aids in reducing the spasm as well as the effusion and edema. The problem of whether to increase or decrease the patient's activity depends a great deal on the estimation of the patient's physical reserve, ability to withstand pain, and cooperation. These injections were nearly always accompanied by heat, massage, and graduated exercises. Approximately 70 per cent of these individuals have been able to return to their employment within a few days, but for others manipulation has been necessary, chiefly in those cases that have not responded to conservative measures such as rest, physical therapy, local injections, and immobilization. Gratz⁶ has demonstrated by air insufflation the presence of adhesions about the fascial spaces in the back. These probably occur following the effusion and occasional hemorrhage that occurs after an ordinary sprain. Manipulation or the freeing of these adhesions, accomplished passively after the method of Jostes⁷ or Bankhart,⁸ and carried out gently under general anesthesia if followed by physical therapy with active and passive use of the muscles, has helped in improving another group of these patients. In those patients who are regarded as more or less chronic and who show localized areas of pain, injections of novocain, as well as other anesthetic agents with a more prolonged action, have permitted some stretching, together with active use by the patient, in restoring normal posture and the proper length and position of the fascia involved. In those individuals in whom the contractures have been associated with mechanical derangements of the lumbosacral joints, plaster fixation

over a period of time, followed by a brace, has been associated with treatment for the contracted fascia.

A summary of the above cases shows 90 per cent relief in the acute cases; 60 per cent relief in the chronic cases, excluding fasciotomy.

In the last group of patients are those in whom contractures can be demonstrated and who have not been relieved by these simpler methods. No reliable single sign or test has been demonstrated in these cases. Localized tenderness over the posterior-superior spine of the pelvis associated with pain and limitation of motion on forward bending has been one of the most common findings in these cases and has been regarded as an indication for posterior stripping of the fascia from the posterior-superior spine. In cases where there is apparent contracture of the sacrospinalis fascia with tenderness localized there, this fascia has been severed in a curved fashion through the same incision. In those patients in whom the tenderness was present laterally over the iliotibial band and in whom there was associated contracture of the fascia together with radiation down the thigh, the lateral fascia was severed through an oblique lateral incision. In several cases both structures were attacked in an attempt to relieve pain, and in one individual it was necessary to operate upon both sides before final relief was obtained.

The posterior operation is performed through an incision about five inches long, beginning over the posterior-superior spine of the ilium and curving down to the inferior spine. The fascia is incised along the crest of the ilium and stripped subperiosteally from the pelvis down to the upper margin of the greater sciatic notch. The stripping is continued medially to the sacrum and down to the inferior spine. When the lateral fascia is to be severed, an oblique incision about four inches long is made between the anterior-superior spine of the ilium and the trochanter. The fascia is divided transversely, each septum between the muscle being included. The wounds are closed by means of subcutaneous and skin sutures after careful hemostasis. No postoperative fixation is used and the patient is permitted out of bed in three to five days. His activities are restricted by his degree of comfort. In all, 17 posterior strippings were carried out. In 9, the posterior stripping was associated with a lateral fasciotomy, and in 2 only the lateral fascia was attacked.

In these cases there was complete and total relief in 12; only partial relief in 3. One of the latter became infected and has an adherent scar. The remaining three obtained no relief by this procedure. Incidentally, two of these showed evidence of mechanical instability at the lumbosacral joint but still will not permit

fusion. The first of these operations was performed in April, 1935, and the most recent one included in this series, more than a year ago.

The following case histories are typical examples of the various types encountered.

REPORT OF CASES

CASE 1.—Mr. B, aged 34, complained of pain in the lower part of the back and left leg down to the knee. He had been thrown from a lumber train, twisting his back. Treatment during the past three years had consisted in adhesive strapping, injections of vaccine, and heat. He had been unable to return to work. Upon examination tenderness was found to be localized over the left posterior-superior spine and lumbosacral angle. There were no positive leg signs. X-rays and examination of the spinal fluid showed no abnormality. Injection of novocain 1 per cent relieved both local and referred pain. Posterior fasciotomy gave complete relief with return to work in six weeks.

CASE 2.—Mrs. T, aged 83, had complained of pain in the lower part of the back and right hip since she had slipped to the ground. She had been treated for three years by adhesive strapping and heat, but the pain became so severe that she was confined to bed, and metastatic malignancy had been suspected. Examination revealed only tenderness over the posterior-superior spine of the right ilium with tenderness over the iliotibial band, and marked restriction of adduction. X-ray showed osteoporosis of the posterior margin of the pelvis on the right. Both posterior and lateral fasciotomy were done under local anesthesia. She obtained complete relief and was able to go home in a car six days later. She was still completely relieved four years later when she died from pneumonia.

CASE 3.—Mrs. C, aged 36, first complained of pain in the lower part of the back and left hip after a fall down stairs. She had been in a plaster jacket without much relief; later a manipulation had been done. Examination showed localized tenderness over the left posterior-superior spine and iliotibial band. Referred pain extended into the calf. X-ray showed a congenital abnormality with mechanical instability of the lumbo-sacral joint. Lumbosacral fusion was advised but refused. After ten days, relief from one injection of procaine was obtained, fasciotomy was performed, both posterior and lateral, and relief was complete for five months, at which time her pain returned. She has still refused fusion.

Experience with these cases seems to indicate rather definitely that there are patients who have a fibrositis of the posterior fascia and ligaments in association with a rheumatoid arthritis, and that in these instances tenderness and pain are usually diffuse and the localized points of tenderness are scattered. These cases, in general, have responded to rest, immobilization, and support. However, 11 patients were treated by injections of novocain into tender areas. Five were not well localized and did not obtain relief. In six, who related a recent strain and showed localized tenderness, relief was obtained. A minimal degree of inactive arthritis is not considered as a contraindication to fasciotomy. Persistent soreness following

operation has occurred in a few cases until relieved by heat and massage.

SUMMARY

In general, patients with an acute traumatic injury to the soft structures of the lower back respond satisfactorily to conservative measures of physical therapy, rest, and immobilization, if not completely relieved by injections of procaine, under which they may be kept more or less mobilized.

Manipulation is reserved for those patients who do not seem to be able to obtain complete recovery alone, and consists in guarded stretching and not too forceful handling in combination with physical therapy.

Operation is still further restricted to those cases in which the symptoms persist, unrelieved by conservative treatment, and remain well localized. The chief indications for operation are:

1. Localized tenderness at or near the posterior-superior spine of the pelvis without diffuse muscle tenderness;
2. Painful forward bending;
3. Painful straight-leg-raising for the posterior group;
4. Lateral contracture with limitation of adduction in the lateral group.

A temporary response to the injection of procaine is a desirable but not a necessary postulate. The patient must be carefully studied to rule out all other causes for pain before proceeding with an operation, the purpose of which is to release the tension of the ligaments, fascia, and muscles attached either posteriorly or anteriorly along the brim of the pelvis.

Many acute cases have been relieved entirely by the injection of procaine associated with physical therapy, while others have been relieved by various conservative means. If the conception of ligamentous strain as the source of pain in the more persistent cases is correct, mobilization should prevent its occurrence in the acute ones. In those more chronic cases injections of anesthetic material have aided in the treatment but have not given as good results as in the acute cases. Repeated injections have been necessary in the large majority of cases before relief is obtained. In an especially selected group showing definite symptoms, fasciotomy both posterior and lateral has proven itself a valuable adjunct in the treatment of these cases. Heretofore such patients have been treated by stabilizing operations. As compared with fasciotomy, they do not afford any greater relief, and they entail a more serious, prolonged operative

procedure. Moreover, since they are followed by months of fixation, they are both economically and physically more costly. On the other hand, fasciotomy in properly selected cases gives as much relief as arthrodesis, allows a much earlier resumption of physical activity, and is, on the whole, a much simpler procedure.

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THE MANAGEMENT OF FRACTURE-DISLOCATION OF THE NECK

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THE ever increasing toll of highway accidents places a tremendous responsibility on the practicing physician. It is estimated that upwards of 35,000 persons each year die within the United States as a result of injuries sustained in automobile accidents¹. This is amazing; yet it is equally appalling to consider the hundreds of thousands that are rendered partially or totally disabled as a result of these accidents. Injuries to the spinal column either with or without concomitant cord damage constitute a problem of the greatest magnitude. The incidence of fracture-dislocation of the neck is becoming increasingly more prevalent. It, therefore, behooves us as practicing physicians to acquaint ourselves with the problem involved, and to become familiar with recent and accepted methods by which these problems may be handled.

In this communication we would like to present a comparatively simple method, illustrated with a few case reports, by which fracture-dislocation of the neck can be successfully handled. We claim no originality in the method; we wish only to clarify some of the problems involved, and to simplify a situation which we believe heretofore has been unnecessarily complicated.

Even at the present time the term "broken neck" to the lay mind is more or less synonymous with certain death, and this view is even held by some of our medical confreres. This misconception is probably due to the fact that, before the advent of x-ray and its widely disseminated use, fracture-dislocations of the neck were diagnosed only when there was evidence of severe and irreparable cord damage, which is nearly always fatal when the injury is as high as the cervical portion of the cord.

Fracture-dislocation of the spine differs from fracture of other bony structures only because of the intimate association of the spinal cord to the vertebral column. The presence of so vital a structure would naturally presuppose means for its protection, regardless of the method employed in handling disruption of its bony covering. The fundamental principles of accurate anatomic reduction and complete immobilization of fragments, however, remain unchanged. If it is accepted that immediate reduction and adequate immobilization is of primary importance in the treatment of fractures of the

long bones, then it is doubly imperative in fracture-dislocation of the spine that immediate restoration of accurate anatomic alignment and complete fixation of the involved portion of the vertebral column be accomplished, in order to protect the cord and rescue the patient from a potentially dangerous situation.

Various methods of handling fracture-dislocation of the neck are at our disposal: i.e., closed reduction by manipulation; open reduction with laminectomy; and indirect reduction by traction. Each of these methods has its merits, and there are times when neither will answer the purpose of the other. We believe, however, that the vast majority of fracture-dislocations of the neck can be safely, easily, and expediently handled by the closed manipulative method. We believe that this method offers the greatest chance of success with the least danger to the spinal cord, and that it materially shortens the period of hospitalization and thereby lessens the expense to the patient, which is a factor worthy of consideration.

The method which we employ today is the same as that advocated by Walton² half a century ago, and recently re-emphasized by Langworthy³. Before describing the method it might be well to consider first the mechanism of dislocation. Perhaps the commonest form of dislocation, without fatal results, is the unilateral form in which the articular process slips forward over the one below and lodges in the intervertebral notch. This causes the head to cant to one side and to twist so as to produce a position similar to that assumed in torticollis. For example, if an articular process on the left has slipped over the process below, the head will be rotated with the face to the right. If the articular process has slipped down into the intervertebral notch, the head will be tilted to the left, the face being still rotated to the right. In order to correct this deformity the mechanism must be reversed. In other words, to reduce a left-sided unilateral dislocation, the head is first flexed sharply to the right. This lifts the articular process out of the intervertebral notch and raises it above the crest of the articular process below. The head is now rotated to the left in order to throw the upper facet back and down to seat itself firmly on the lower facet. The neck is then hyperextended to maintain the reduction. In a right-sided dislocation the movements are reversed.

In bilateral dislocations the manipulation is carried out separately for each side, one side being reduced at a time. The original Walton maneuver was carried out with the patient in the sitting position. We find it more convenient and expedient to do the manipulation with the patient in the dorsal recumbent position, lying on the Hawley table with the upper half of the body resting on the horizontal metal

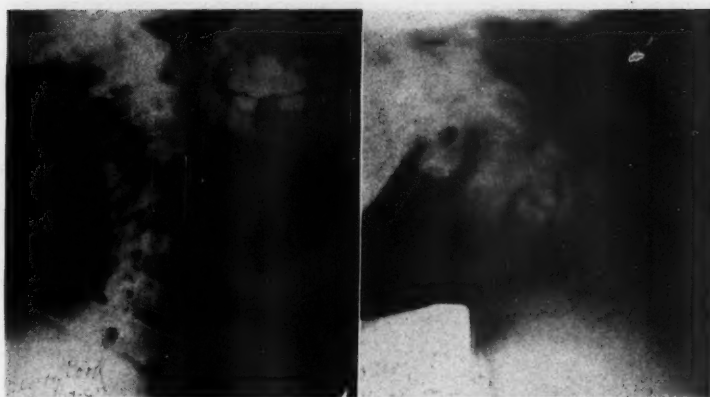


Fig. 1. a. Before reduction.

b. After reduction.



c. Recurrence six months after injury.

CASE 1. Mr. H. C., aged 27, was driving while drunk and the car overturned. He was first seen two weeks after the accident, complaining of pain and tenderness of the neck with rigidity of muscles. X-rays revealed dislocation of the third cervical vertebra, fractured spinous process of fifth cervical vertebra. The dislocation was reduced manually under anesthesia and plaster cuirass applied. The patient was uncooperative and difficult to handle. He refused to wear the celluloid collar after removal of the plaster cuirass, and he continued to get drunk. X-rays taken six months after injury showed partial redislocation (fig. 1 c). There was full range of motion. He complained of periodic pain in neck and numbness of hands.

plate which supports the dorsal spine. The patient is held in this position by two assistants, who support the arms and shoulders.



Fig. 2. a. Before reduction.

b. After reduction.

CASE 2. J. J., a Negro of 28, was run over by an automobile backing on a dirt road. He was first seen two days after injury. There was marked rigidity of the neck with exquisite tenderness over the fifth spinous process. No neurologic signs were observed. X-rays revealed dislocation of fifth cervical vertebra with probable fracture through its body. Manual reduction was effected under anesthesia and plaster cuirass applied. He was discharged from the hospital three days after reduction.

The patient's head rests in the hands of the operator, who is free to carry out the manipulative procedure. As pointed out by Walton⁴, the keynote to successful reduction is *direction* of application and not *force*. When the neck is placed in acute lateral flexion, the hand of the operator and transverse process of the vertebra act as a fulcrum, and the displaced articular process is easily lifted over the crest of the lower facet. Rotation of the head then completes the reduction by firmly seating the upper facet on the lower facet. The reduction is maintained by allowing the head to fall back in hyperextension. Misapplied traction will actually hinder reduction. We have not found it necessary to employ the Taylor⁵ technic in any of our cases.

We feel that it is important to perform the reduction with the muscles in a completely relaxed state, and this relaxation is best obtained by a general anesthetic. We prefer basal anesthesia of avertin, supplemented by vinethane inhalation. Occasionally we have found it necessary to give drop ether in order to obtain complete muscular relaxation. Under anesthesia the manipulative procedure can be easily controlled, and we believe that the spinal cord is subjected to less risk than if reduction be attempted without anesthesia. Often when reduction is accomplished a distinct snap can be heard or felt when the displaced facet reseats itself. The position is

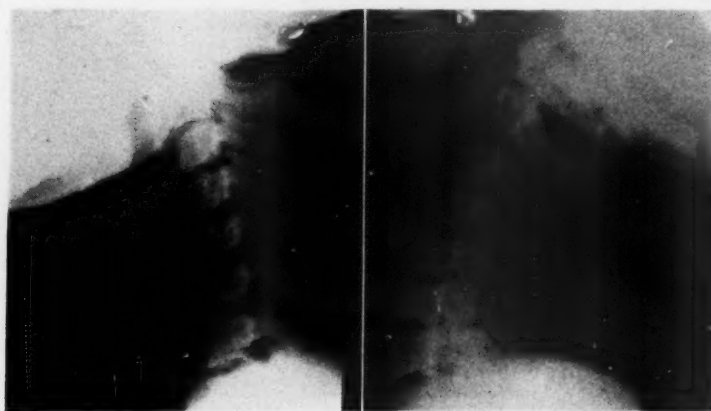


Fig. 3. a. Before reduction.

b. After reduction.

CASE 3. A white girl of 22 was riding in a car which skidded on a wet pavement and overturned. She was first seen two days after the injury. Severe pain, tenderness and rigidity of the neck were present. No evidence of cord injury could be elicited. X-rays showed partial subluxation of the fourth cervical vertebra. Manipulative reduction was accomplished under anesthesia and plaster cuirass applied. She was discharged from the hospital one week after reduction.

then checked by the portable x-ray unit, and if satisfactory, a plaster cuirass is applied with the head and neck in hyperextension.

The importance of applying a carefully molded, snugly fitting, plaster cuirass cannot be overemphasized. The recurrence of partial dislocation in one of our cases (case 5) is directly attributable to a loosely fitting cast. Indeed, we find the application of the cuirass much more difficult than the actual reduction of the dislocation. One very helpful point is to suspend the occiput after reduction by a sling of six-inch roller bandage hanging from a metal hook in the ceiling directly above the patient's head. This helps to maintain the proper position of the neck and greatly facilitates the application of the plaster. This sling can easily be slipped from under the occiput after the plaster has set. Jersey tubing or stockinet is placed on the patient in two sections, one for the thorax and shoulders and one for the head and neck. It is important to see that this is fitted properly and that there are no wrinkles or folds. The pressure bearing areas, i.e., the occiput, the chin and mandibles, and shoulders are padded with sections of one thickness of felt. These are carefully cut to pattern and sewed together to hold them in place. It is important to pad the anterior surface of the neck and to cut out a place in the felt for the larynx. Several turns of glazed cotton are then applied

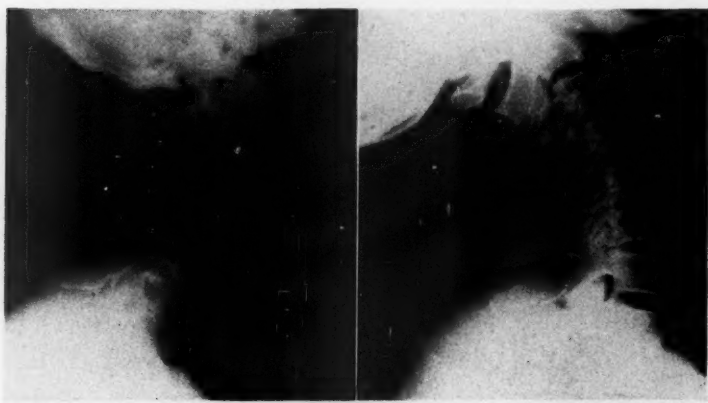
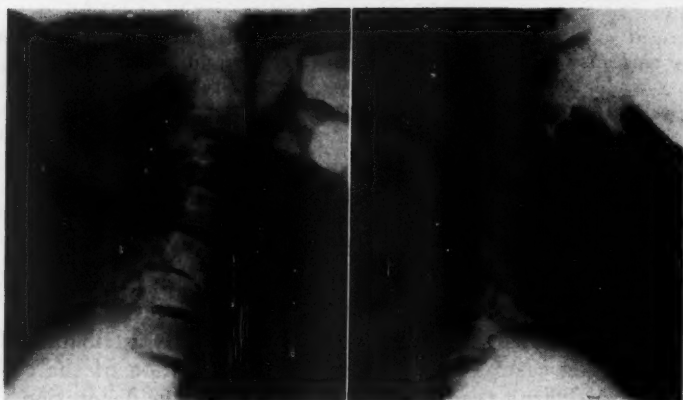


Fig. 4. a. Before reduction.

b. After reduction.

c. Recurrence while in cervical support
six months after injury.

d. Final reduction.

CASE 4. Mr. C. H., aged 60, while working on a screen in a second story window, fell to the ground. Severe pain, tenderness, and rigidity of the neck, and aching and numbness of the arms ensued but no muscular weakness or paralysis. X-rays revealed marked forward dislocation of the fifth cervical vertebra with fracture and separation of posterior bony arch. There were also compression fractures of the bodies of the fifth and sixth vertebrae. Manipulative reduction was carried out under general anesthesia and plaster cuirass applied. The patient was discharged from the hospital two days after reduction. The plaster cuirass was removed at the end of the second month and an adjustable metal cervical support was substituted. This apparatus did not give adequate support and four months later x-rays revealed partial redislocation (fig. 4 c). Reduction was again accomplished without difficulty by the Walton maneuver (fig. 4 d).

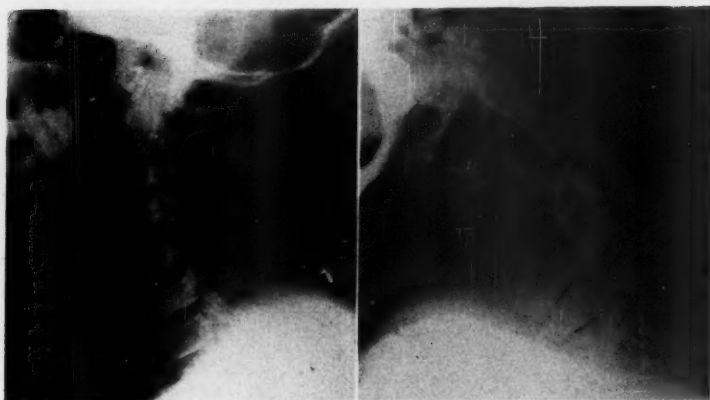


Fig. 5. a. Before reduction.

b. After reduction.



c. Recurrence while in cuirass

CASE 5. Mr. E. H., aged 43, was riding in an automobile which collided with another car and overturned. He complained of severe pain in the region of the left shoulder and exquisite tenderness over the humeral head. There was minimal pain and tenderness over the middle cervical spine. He could turn his head in all directions without much pain. X-rays of the shoulder were negative for fracture. X-rays of the neck revealed dislocation of the fifth cervical vertebra. Manipulative reduction was carried out under anesthesia with immediate relief of root pains. He was discharged from the hospital ten days after reduction. The plaster cuirass did not fit properly and three weeks after injury the patient began to complain of numbness in the fingers of the right hand. Re-examination by x-ray revealed partial redislocation (fig. 5 c). This was subsequently reduced with relief of paresthesia.

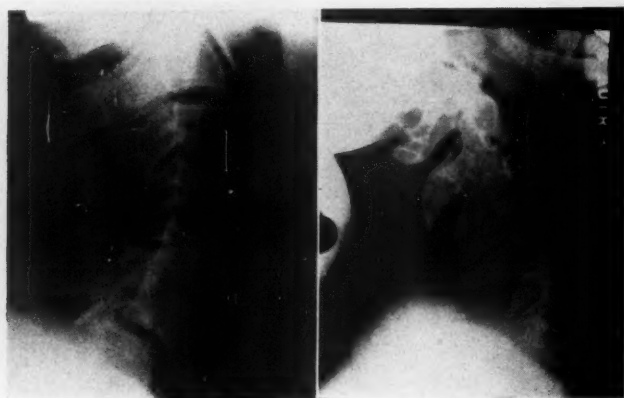


Fig. 6. a. Before reduction.

b. After reduction.

CASE 6. When his clothing became caught in the belt of a saw mill, Mr. J. A., aged 51, was whirled around, striking his head against the ground. There was evidence of complete transection of cervical cord. X-rays revealed fracture-dislocation of the sixth cervical vertebra. Root pains radiating down both shoulders and arms were excruciating. The dislocation was reduced manually and the root pains relieved immediately. Plaster cuirass was applied. The quadriplegia and level of anesthesia showed no improvement. The temperature rapidly rose and the patient died three days after injury.

around the thorax and head. Care must be taken not to pad the cast too thickly. The plaster is then applied, carefully molding it to conform to the configuration of the neck, chin, and shoulders. Molded plaster splints properly placed will materially strengthen the cast, making a heavy cumbersome cuirass unnecessary. It is wise not to place the neck in extreme hyperextension, for in this position swallowing is almost impossible. Cutting a window over the larynx adds greatly to the comfort of the patient.

Although vomiting has occurred in none of our patients following reduction under general anesthesia, we recognize this potential danger and suggest that a portable suction unit be kept constantly at the bedside until the patient has completely reacted, and the danger of emesis has passed. We allow our patients out of bed as soon as they have become adjusted to the cast. This is usually within the first five or six days, provided there are no other associated injuries which necessitate bed care. The plaster cuirass should be worn for a minimum of ten to twelve weeks, and during this time there should be periodic x-ray check-ups to see that complete reduction is being maintained. After the cuirass has been removed the patient should be fitted with a molded celluloid collar support. This should be



Fig. 7. a. Before reduction.

b. After 5 weeks in halter traction.
Note that the dislocation is still unreduced.

CASE 7. A. H., a Negro, aged 38, received an injury to the neck when his car ran off the road and overturned. X-rays revealed dislocation of the fifth cervical vertebra. Manual reduction was not attempted. Twelve pounds of traction was applied for a period of five weeks, using a leather halter sling under the mandibles and occiput. At the end of this time a plaster cuirass was applied and the patient was discharged from the hospital. The discharge note stated that he was comfortable and free from pain, although dislocation was still unreduced. (This case was taken from the files of James Walker Memorial Hospital, Wilmington, N. C., and is included in this series to show the inadequacy of traction as a method in handling dislocation of the neck.)

worn for an additional period of three to six months and then gradually discarded.

DISCUSSION

Great force or violence is not necessary to produce dislocation of the neck. Occasionally an awkward movement of the head, or a trivial thing like sneezing will produce a unilateral or rotary type of subluxation⁶. The same type of dislocation is not infrequently seen during the prodromal stage of an acute illness in childhood and is often misdiagnosed as toxic torticollis⁷. This error can be avoided if it is remembered that in toxic wry-neck the head is rotated and held down by a shortened spastic sternomastoid muscle; whereas in rotary dislocation of the neck the head is twisted and held down by a bony block, and the shortened sternomastoid muscle on the down side of the head is soft and flaccid, while the corresponding muscle on the upward side is taut and prominent. Roentgenograms are not always helpful, as simple rotary subluxations are difficult to demonstrate conclusively on the x-ray films. It is important, however, to take roentgenograms in all cases of suspected fracture-dislocation

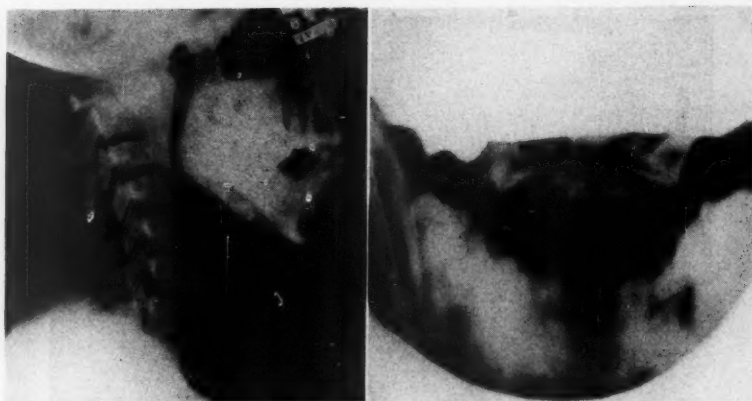


Fig. 8. a. Lateral view.

b. View through open mouth.

CASE 8. E. D., a colored girl of 19, walked into the hospital complaining of pain in her head and neck, weakness and numbness of the upper extremities. Three weeks before admission she had fallen across a ditch and struck her head. She continued her duties as a domestic servant for three weeks, until pain and weakness forced her to seek aid. There was marked rigidity of the neck muscles with the head displaced forward and turned to the left. There was weakness of all groups of muscles of the upper extremities. Sensory changes were not definite. X-rays revealed a fracture through the base of the odontoid process with slight lateral displacement, and marked forward displacement of the atlas. A good reduction was obtained by manual manipulation under general anesthesia. A plaster cuirass was applied, and the patient left the hospital three weeks later symptom-free. (House Service, James Walker Memorial Hospital.)

of the neck, and an anteroposterior view should be taken through the open mouth to show the atlanto-axial relationship. This view often clears up a puzzling situation by demonstrating a fracture through the odontoid process.

Injuries to the cervical spine are frequently associated with other skeletal injuries, and all accident cases should be thoroughly examined for spinal column injuries. In fracture-dislocation of the neck, there is always damage to the supporting soft tissues in addition to bony injury. Intervertebral disks are contused; joint capsules and ligaments are torn; and there is variable damage to nerve tissue. Damage to the spinal cord at times is out of all proportion to the apparent damage of the vertebral column as demonstrated by the x-ray, and conversely the opposite may be true. Damage to the spinal cord is usually immediate at the moment of impact. After the causative force has spent itself, recoil of the spine may effect a spontaneous reduction. On the other hand, a fracture-dislocation of the neck with marked forward displacement (case 4) may show



Fig. 9.

CASE 9. D. H., a colored boy of 21, was brought to the hospital in a semistuporous condition with partial paralysis of upper and lower extremities. At first no history of trauma could be obtained. There was rigidity of the neck, and the temperature was elevated to 101°. Lumbar puncture revealed clear, colorless fluid, under normal pressure with no evidence of subarachnoid block. A traumatic lesion was not suspected until three days after admission, when a friend revealed that the patient had fallen down a flight of stairs while drunk. X-rays were then taken and revealed extensive crushing and compression of the body of the fifth cervical vertebra. The patient died five days after admission.

little or no neurologic involvement. As demonstrated by Brookes⁶, fracture complicating dislocation may be actually life-saving in effect, allowing the body of the vertebra to be displaced completely while the posterior bony arch remains attached to the intervertebral ligaments, and thereby prevents guillotine or crushing of the cord. In cases of dislocation complicated by fracture of the posterior arch, reduction is very difficult to maintain; and it is in these cases that a well-fitted plaster cuirass is imperative.

Dislocation of the neck, with or without cord damage, is an emergency of the first order and demands immediate treatment. We believe the safest and most expedient form of treatment is the closed manipulative method described above. Even in the presence of cord compression, surgeons are beginning to realize the futility of laminectomy. Brookes⁷ goes so far as to say that open reduction has no place in the treatment of acute injuries of the cervical spine. Laminectomy relieves the posterior pressure on the cord but leaves it angulated over the edge of the displaced vertebral body. Taylor⁵ mentions three cases of fracture-dislocation of the neck which were treated by laminectomy and splitting of the dura. In each case as

the dura was incised, the cord fractured and extruded itself. All cases terminated fatally shortly after operation.

The problem of cord damage is a profound one. It is at times impossible to differentiate between physiologic and anatomic interruption of cord function. The Queckenstedt test offers little aid. It discloses only the presence or absence of subarachnoid block, and not the presence of cord compression as is commonly believed. It is conceivable to have localized compression of the cord without complete subarachnoid block. We believe that cord compression due to dislocation should be relieved in all cases as soon as possible, regardless of the extent of damage to the cord. Manipulative reduction offers the safest, easiest, and most expedient method by which bony pressure on the cord can be relieved. Coleman⁸ has substituted skeletal traction for laminectomy in cases of complete cervical injuries with dislocation. This traction is applied through skull tongs⁹ placed in the outer table of the parietal regions. Reduction by traction is not always complete, and when it is complete a variable length of time is required before reduction takes place. No traction apparatus yet devised will completely immobilize.

We feel that the essential requirements in handling fracture-dislocation of the neck are more completely fulfilled in manipulative reduction and fixation in plaster cuirass, than by any other method. Root pains, which at times are excruciating, are relieved immediately upon reduction. The plaster cuirass immobilizes completely, favors more perfect union with the least callus formation, shortens the hospital stay, and greatly simplifies nursing care.

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THE EMERGENCY TREATMENT OF BURNS

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THE development of the eschar method in the treatment of extensive burns represented a signal advancement in the management of these accidents. Davidson⁷, in 1925, while casting about for a safe protein coagulant for use in producing an eschar hit upon tannic acid and with it was able to reduce mortality significantly. The silver nitrate modification of Bettman⁴ still further improved the method and Aldrich's gentian violet eschar¹ seemed, in many respects, superior to either.

However, the eschar technic did not seem to provide the total solution to the problem of saving these patients. This fact suggested a fallacy in the early belief that its beneficial effects lay in the direction, as it was at first supposed, of preventing the absorption of toxic protein cleavage products from the burned area by coagulating them. For shock continued to kill patients even though satisfactory eschars had been produced. Moreover, Underhill, Kapsinow and Fisk¹⁷ had demonstrated that absorption from burned areas was slight so that even if there remained uncoagulated protein toxins their absorption would take place quite slowly.

It has been known since Baraduc's observations² in 1863 that hemoconcentration was an attendant phenomenon of severe burns. In 1923 Underhill and others¹⁶ measured this concentration and suggested that circulatory failure in burns might be the result of such an increase in viscosity of the blood that the heart could no longer force it through the capillaries. Underhill, Kapsinow and Fisk in 1930¹⁷ demonstrated the increased permeability of the capillaries in the burned area and found a loss of fluid equal to 70 per cent of the total blood volume through these injured capillaries in some instances. Beard and Blalock's³ studies showed that this fluid was identical with blood plasma and thus explained Davidson's⁸ finding that the total circulating plasma protein was reduced following burns. Thus it became apparent that there was a very considerable loss of actual blood plasma into the tissues around a burn and that it was this loss which was responsible for the attendant hemoconcentration. It has been shown in plasmapheresis experiments¹⁰ that uncomplicated plasma loss on a scale no larger than that encountered in extensive burns is productive of fatal shock in animals. Thus it now seems certain that the shock occurring in

the first 24 hours following burns is due principally to this factor. The possible role of toxins in producing some of the ill effects of burns has not been ruled out, however.

The detrimental circulatory changes which follow this loss of plasma have been depicted by Moon¹⁴ as a vicious circle ending in vascular collapse. He points out that the loss of blood volume results in lowered cardiac output and consequent deficient delivery of oxygen to the tissues. As has been shown by Landis¹¹ tissue anoxia results in capillary atony and increased endothelial permeability throughout the body so that what began as local loss of fluid from the blood ends in still further loss of fluid generally. This increases even more the discrepancy between the capacity of the vascular tree and the volume of blood available to fill it. This disparity between blood volume and volume of the vascular system constitutes the basis for the definition of shock which is now subscribed to by both Moon and Blalock. In severe burns the plasma loss is great and the volume disparity large so that the need for effective restoration of blood volume is urgent. Along with this fluid shift there is a gradual disturbance of the electrolyte balance as chloride is lost and alkali reserve lowered.

We now have a fairly clear concept of the physiology of the shock which occurs in the first 24 hours following burns and have at our disposal means of combating these changes. Still after 24 to 72 hours a syndrome may appear which begins in lowered blood pressure, hyperpyrexia and tachycardia and, in severe cases, progresses to coma and death. These phenomena are seen even in patients whose hemogenic shock has been brought under control so that its explanation is somewhat obscure and it may be that the old toxin theory will find application in at least some of these cases. Aldrich¹, in trying to explain the shock occurring in the early stages, suggested that bacterial toxins developing in infected burn area entered the blood stream and caused shock. Although this theory does not now seem tenable it very likely has its place in accounting for a number of these later deaths. Aldrich thought that the beta hemolytic streptococcus was the organism involved and it is interesting to note in this connection the recent report by Stewart¹⁵ of four cases in which postoperative shock was attributable to fulminating hemolytic streptococcus wound infections. A frequent accompaniment of this secondary toxemia is liver necrosis. Whether this is due to toxins or anoxemia is not now known but it seems to be an important factor in some deaths. McClure¹² reported one case in which extreme liver damage was found at autopsy and a second in which jaundice and hepatic enlargement gave evidence of damage. He attributed the recovery in the latter case to

the administration of large amounts of glucose to promote liver regeneration.

With these ideas in mind the emergency treatment of serious burns becomes a rational correction of disturbed physiologic processes. The burned patient is put to bed under an electric cradle on sterile sheets and is given morphine for the relief of pain. Then either a hematocrit reading, a hemoglobin estimation, a red cell count or a combination of these is made to provide a base reading against which the frequent subsequent determinations may be compared. We then give 250 c.c. of plasma in 250 c.c. of normal saline solution and thus try to control shock at its beginning by replacing the plasma which is being lost through the capillaries of the burned area.

All grease and foreign matter are removed with ether and the burn cleaned with soap and water. Blisters are opened and all dead skin removed, taking care that rigorous aseptic precautions are observed. A careful irrigation with sterile saline completes the cleansing operation and the wound is prepared for the formation of an eschar. The choice of a tanning agent is a more or less free one but we prefer gentian violet to tannic acid because the latter produces such a tough eschar that it is difficult to detect infection under it. Moreover the tannic acid crust shrinks and cracks and curls at the edges to such an extent that it not only leaves small rifts in the armor but also may become painful. Gentian violet produces a thin, pliable, eschar which is not liable to crack and which has some antiseptic properties. On burns involving the hands and face, however, we use K-Y jelly for the first 24 to 48 hours and thereafter saline soaks since the frequent movement of these parts will cause cracking of even gentian violet eschars and render the areas more susceptible to infection. Should infection occur under the eschar it should be removed and the infected area thenceforth treated with saline soaks. We believe that the soaks are best because they provide adequate irrigation of the infected area and at the same time keep the tissues in condition to receive skin grafts if they should be needed later.

Even more important than this local treatment, however, is the problem of recognizing and dealing with shock in its early stages. Moon has pointed out that long before the classic signs of shock, low blood pressure and rapid thready pulse, have made themselves manifest hemoconcentration has occurred and in a degree which provides unmistakable evidence of the approach of this dreaded complication. Clinical shock occurs only after compensatory methods of sustaining blood pressure, such as vasoconstriction and

increased heart rate, have gone their limit and failed. It has been shown that hemoconcentration parallels the loss of plasma so that by keeping a watch on some such index of concentration as the hemoglobin value we may be able to determine the amount of plasma required to restore the blood volume. Black⁵ has expressed the relation of plasma deficit to hemoglobin reading in a formula from which he demonstrates that a rise of hemoglobin from 100 per cent to 105 per cent represents a loss of about 250 c.c. of plasma. By watching the hemoglobin at intervals of a few hours we determine, by reference to Black's table (figure 1) the amount of plasma required. The duration of plasma therapy is dependent, of course, on the continuance of plasma loss and this goes on until normal permeability is restored to the capillary walls. When this desirable condition is attained further blood concentration is checked and hemoglobin readings become stabilized.

TABLE 1

<i>Hemoglobin</i>	<i>Estimated Plasma Deficit</i>
%	c.c.
100	—
105	250
110	450
115	650
120	850
125	1,000
130	1,150
135	1,300
140	1,450
145	1,550
150	1,650

From Black⁵

The recent studies of Ravdin, Whipple and others^{9, 13} have shown that an adequate protein supply is necessary for liver regeneration. In view of the frequent occurrence of liver necrosis this provides a second excellent reason for plasma therapy.

Since anoxia will of itself bring about increased capillary permeability and aggravate plasma loss there is good reason to believe that patients with severe hemoconcentration may benefit from oxygen therapy. Black⁵ mentions the striking improvement in the condition of shock patients to whom oxygen is administered. In the face of very high hemoglobin readings we administer 100 per cent oxygen with a Boothby⁶ mask.

In addition to plasma the burn patient will also require sufficient fluid to maintain normal water and electrolyte balance in the unaffected parts of the body. However, an excess of fluids will dilute

the already lowered plasma proteins to the edema level and thus wash out still more plasma. Too free use of saline, then, must be avoided. We give plasma which has been stored with equal amounts of saline and think that this usually supplies an adequate amount of fluid and electrolyte. McClure's¹² experience with glucose in treating liver damage indicates, however, the necessity of maintaining, parenterally if necessary, a high carbohydrate intake.

In summary it may be said that burn treatment falls into two divisions, topical and systemic. Absolute cleanliness and protection of the wound form the basis for the topical management while restoration of protein and electrolyte imbalance through adequate plasma therapy is the key to systemic treatment. It is our belief that far more consideration should be given the question of what shall be put *in* the patient than to what shall be put *on* him.

Supporting the toxin theory as a cause of death in some cases of burns, Wilson¹⁸ has been able to demonstrate a toxin that is caused by the autolysis of burned tissue. Rosenthal¹⁹ found a histamoinoid substance in burned tissue which substance is neutralized by serum of the recovered burned patient.

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THE INTERDEPENDENCE OF MEDICINE AND SURGERY

It is both a pleasant and difficult task that I have today, in undertaking to discuss the interdependence of medicine and surgery. It is pleasant because the very title of this paper indicates that we have long since ceased to recognize any antagonism between the two great cornerstones of medicine. It is difficult since the pattern of the fabric by which medicine and surgery are joined is so intricate that it is not always possible to find the line of cleavage. This is as it should be, for there is a certain unity in all healing, and such division as does exist should be due only to the vastness of modern medical knowledge and the inability of any one individual to master it as a whole.

How vast would be the benefit to humanity if the skill and knowledge of the great surgeon and the great physician could frequently be combined in one person as it was in Hippocrates! Hippocrates, known as the father of medicine, was hardly less the father of surgery. He has left records of extensive knowledge and skill in the treatment of wounds and dislocations. He taught the need of surgical cleanliness and observed a rather rigid operating room technic. His observations on the effects of cerebral injuries were strikingly accurate and he outlined the most essential factors in the treatment of fractures. In addition, he wrote on diet, on prognosis, on climatology, and on acute and epidemic diseases. Today it seems impossible that the entire field of medical knowledge can be encompassed by one mind. Close integration of medicine and surgery will, however, be productive of the most benign results

Read before the Postgraduate Surgical Assembly, the twelfth annual meeting, of The Southeastern Surgical Congress, Richmond, March 10, 11 and 12, 1941.

on the patient and on the advancement of the science of medicine. Perhaps it is not too much to hope that this interrelationship may become so close, so perfectly entwined, that these two branches may function as a unit, with the single purpose of relieving the misery of mankind. Thus will the Hippocratic ideal be reborn.

I might impose upon your time by tracing the course and development of medicine and surgery through the centuries. I might recall the bitter controversy and rivalry that raged between the physician, the surgeon, and the barber, and how the physician, puffed up with conceit and steeped in ignorance, deemed it beneath his dignity to take part in the shedding of blood, describing the surgeons as "booted lackeys—a race of evil, extravagant coxcombs who wear mustaches and flourish razors."

It would seem more profitable, however, to approach the subject from a practical standpoint and consider it in the light of our present day knowledge and experience. The great expansion of medicine in modern times and the development of instruments of precision, of laboratory technic, and of special procedures have necessitated the division of medicine into various special groups. That this is no new thing is recorded by Herodotus, who observed that in Egypt the profession was divided into specialties and that "each physician applies himself to one disease, not more. All places abound in physicians. Some physicians are for the eyes, others for the head, others for the teeth, others for the intestines, and others for internal disorders." These last must have been the founders of internal medicine. It is true that specialization today is based on more rational grounds, but it still tends to the disruption of the unity of medicine. The necessity of specialization is freely admitted, but we cannot fail to see the dangers of concentrating on a narrow sector of medicine. The very fact of being highly trained to see certain things tends to produce blindness to objects outside of our immediate field of vision. If we are to have specialists, it follows that we must have generalists also who can fit together the various parts of the mosaic and can stand far enough back to see objects in their entirety.

Here is the first point of agreement between the physician and the general surgeon, since we are both concerned with the body as a whole. The physician has learned that a pain in the abdomen may have its origin in the most distant part of the body and the surgeon knows that surgical intervention in one organ may have many remote results. The unity of thought between the two great branches of medicine was impressed upon me recently when I saw the questions put to candidates by the American Board of Surgery. Of five questions, four might just as well have been given to those

taking the examination of the American Board of Internal Medicine. Thus far have internal medicine and surgery been joined together.

It is significant that many of the great advances in medicine have occurred since the hand of the surgeon was freed by the discovery of methods of producing anesthesia and by the development of antisepsis and asepsis. As pointed out by Moynihan, these great discoveries enabled the surgeon and the physician to observe and study living pathology in relation to symptoms at the time the symptoms were present. Prior to this the main reliance was placed on postmortem findings. In many instances at autopsy the primary source of the disease process was lost in a maze of secondary changes. With the development of modern surgery, the relationship of symptoms to disease of certain organs, especially of the abdominal cavity, has become more clearly understood. The physician has been forced to discard his ancient standby, dyspepsia, and to substitute the various syndromes associated with specific pathology in the stomach, duodenum, gallbladder, appendix, and other viscera.

It is impossible to acknowledge all the debt that medicine owes to surgery. The advances in surgery of the brain, the thyroid, the chest, the pelvis, the urinary tract, and the gastrointestinal area are well known. To the surgeon we owe much of the credit for the great gain that has been made in the control of cancer. He has attacked with some success the problem of adhesive pericarditis and has advanced into the more debatable field of cardiovascular disease. Although I believe that few internists are greatly impressed so far with the results obtained by a total thyroidectomy, or by ganglion and nerve root section for angina, or by the various operations on the sympathetic system to control vascular hypertension, we welcome help in a field in which we have notably failed. Certainly, these experiments, when well controlled, are worth while and will add to our understanding of the problem of cardiovascular disease.

The realm of surgery has been greatly extended by advances in medical knowledge. Whole groups of individuals have become surgical possibilities who at one time were exempted on account of operative risks and in other instances operative mortality has been greatly lowered by preoperative and postoperative care. In the pre-insulin days, the diabetic was a poor medical and a poorer surgical risk. If he were assailed by any acute condition, his doom was almost certainly sealed. Not only did the diabetic state accelerate the course of his acute infection, but the infection balefully influenced the downward course of the diabetes. The situation has now been completely changed and the diabetic, properly prepared for opera-

tion, presents no greater risk than any other patient. His complicating illnesses disturb but no longer appall us.

The surgeon has long known that the nutritional condition of a patient is of importance in his recovery from an operation. We now know many of the reasons for this. Our knowledge of the factors that control water balance and that produce edema or dehydration, has been of tremendous value to the surgeon and to his patient. We are concerned with the level of serum protein, with the sodium intake or loss. We know that a loss of certain body metabolites is of vital importance and we have learned how to combat this loss. The surgeon and the internist, working together, have greatly lowered the operative mortality in intestinal obstructions, thyroid disease, peptic ulcers, in severe burns and in various forms of shock. We appreciate the value of a balanced diet and less frequently indulge in lopsided dietary restrictions over long periods of time. Acidosis is no longer feared, although it may seem that an extraordinary quantity of glucose is administered at times. We are aware that in many instances when conditions requiring surgery are present, nutritional deficiency dominates the picture and must be corrected before surgical intervention can safely be undertaken. In certain cases the surgical necessity and the nutritional deficiency are so closely interwoven that it is difficult to determine which therapeutic attack must be undertaken first, and the solution of the problem must require the closest cooperation between the surgeon and the internist.

Advances in cardiology have greatly clarified the problem of surgery on cardiac patients. We now evaluate these patients more on the basis of cardiac function than on evidence of anatomic changes. With this increased knowledge and with improvement in surgical technic, much of our fear of surgery in certain cardiac cases has been removed.

The jaundiced patient is no longer a source of acute concern to us when he presents indications for surgery. The discovery of vitamin K and its application in the control of bleeding in jaundiced patients have removed us from between the horns of a serious dilemma. The great difficulty sometimes experienced in differentiating between obstructive jaundice and intrahepatic jaundice was the cause of our dilemma. We knew that considerable risk attended an operation on a jaundiced patient and we hesitated to subject our patient to this risk, knowing that there was an even chance that no obstruction would be found. On the other hand, we were aware that each day of delay enhanced liver injury in the patient who might be relieved of biliary obstruction by the surgeon. Certainly now, in the light of our present knowledge and with the means avail-

able for combating hemorrhage and liver damage, we are justified in undertaking earlier exploratory operations in jaundiced patients.

The recent amazing advances in chemotherapy have affected the field of surgery as well as of medicine. With powerful bacteriostatic agents that can be introduced into the stomach, the blood stream, and the body cavities at his command, the surgeon may hope to control certain infections already present, or prevent their occurrence. Control of infection may in many instances make surgical intervention possible where before it would have been too hazardous. In other instances it may greatly lower surgical mortality. In some cases it may even do away with the necessity of surgery altogether. Here again is exemplified the importance of a combined surgical and medical approach. While these drugs may act most effectively against what may be termed a disseminated infection, they may fail to eradicate completely the disease when the infection is focalized as a definite abscess. In such cases a sense of false security may arise, only to be followed by disaster if the principle of surgical drainage is neglected. This has repeatedly been illustrated in my experience in staphylococcic septicemia.

These are but a few examples of the interdependence of the surgeon and the internist. This knowledge has come to us from various sources and is not the exclusive property of any one group. The well-qualified surgeon is often as well versed in these facts as are we, but close cooperation is necessary in order to obtain optimal results.

How, then, can this close affiliation between the surgeon and the physician best be brought about? How can the patient be assured of receiving the most that medical science has to offer? Is the large, well organized clinic, with its fine equipment, its specialists in every line, its technicians and special laboratory investigators, the ideal place to receive medical care? I doubt it. Is the organized group, with its business director and card index, its department of this and that, through each of which the patient passes before being given his final report by the master mind of the organization, our present day ideal of medical perfection? I doubt this, also. Neither do I feel that the surgeon who employs a young internist, skilled in all the present-day technic of diagnosis, to care for the medical aspect of his cases, has discharged his full duty to his patients. What would you think of an internist who retained a young surgeon, however well trained in the mechanics of surgery, to carry out the surgical therapeutics of his practice? This second suggestion is perhaps the more reasonable of the two. We have, I fear, become obsessed with the idea of organization. Mere size impresses us unduly. We lose sight of the fact that what the patient wants and needs is a

single physician interested in, and responsible for, his welfare. This physician, whether surgeon, internist, or general practitioner, should be sufficiently informed to evaluate the patient's problem and to call to his side such accessory aids in diagnosis and treatment as he may need. If he be skilled in surgery, he should recognize the need of medical advice in many cases, just as the internist should avail himself of surgical aid when it is indicated.

It is thus seen that surgery and medicine are no longer divided, each claiming for itself a certain portion of the domain of medicine. Both are concerned with the patient as a whole and must be aware of all the factors that affect his welfare. They differ only in their therapeutic approach. It also follows that each must be able to evaluate the other's contribution. To be a good physician one must constantly be informed as to the possibilities of surgery. When a patient is sick, it is our duty to consider all the possible means of restoring his health or of relieving his suffering. There may be several possible approaches, albeit no perfect road. We must weigh the relative risks and benefits in each course we consider and then apply what seems the best therapeutic procedure. We must look upon surgery as a branch of therapeutics and must know its value and its shortcomings, just as we know the various elements involved in other therapeutic procedures.

The surgeon has a right to expect us to consider surgery in its proper relation to the condition and not as a last resort after our other efforts have failed. He has a right, also, to expect us to condition the patient for surgery. We must be cognizant of the patient's personality, of his cardiovascular condition, his renal function, his nutritional state, and of all the various influences that may make for his recovery or his death.

We also have a right to expect much of the surgeon beyond mere technical skill. We expect diagnostic aid in certain fields. We expect surgical judgment in weighing the risk of the procedure considered, and we expect an appreciation and understanding, if not a detailed knowledge, of the various accessory factors, nutritional and metabolic, circulatory and psychic, that must play a part in the patient's recovery.

It follows then that there is no line of cleavage between the surgeon and the internist. The knowledge that each must have is intermingled with that of the other. They are mutually dependent upon each other. To be a great surgeon one must be a good physician, and to be qualified in internal medicine one must know much about surgery.

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BOOK REVIEWS

The Editors of THE SOUTHERN SURGEON will at all times welcome new books in the field of surgery and will acknowledge their receipt in these pages. The Editors do not, however, agree to review all books that have been submitted without solicitation.

SURGICAL DISEASES OF THE SPINAL CORD. By CHARLES A. ELSBERG, M. D., Emeritus Professor of Neurological Surgery, College of Physicians and Surgeons, Columbia University; Emeritus Director of Neurosurgery, Neurological Institute of New York; Consulting Surgeon, Mount Sinai Hospital, New York City. 558 pages, with 249 illustrations. Price, \$14. New York City: Paul B. Hoeber, Inc., 1941.

This volume may be considered a new and revised edition of "Diseases of the Spinal Cord" (1916) and "Tumors of the Spinal Cord" (1925), both of which have stood the test of time as authoritative monographs.

The surgical anatomy, normal and pathologic physiology of the spinal cord, are simply presented, as well as the diagnosis of localized spinal diseases in which surgical procedures may be necessary. The chapter on roentgen ray diagnosis is written by Dr. Cornelius G. Dyke and is well illustrated; the chapter on pathology by Dr. Abner Wolf, likewise is profusely illustrated.

All surgical diseases are fully described, including congenital abnormalities, inflammatory diseases, tumors, as well as primary and secondary diseases of the vertebrae which may produce spinal cord disturbances.

An entire section is given over to herniation of nucleus pulposus, the importance of which is being increasingly recognized.

Surgical technic is described, as well as postoperative treatment.

This book is particularly well written, presenting a great mass of information briefly, concisely, and with many clear illustrations, constituting an ideal reference book. It should be carefully studied by all those who are called upon to diagnose or treat diseases of the spinal cord.

EXUM WALKER, M. D.

ABDOMINAL SURGERY OF INFANCY AND CHILDHOOD. By WILLIAM E. LADD, M. D., F. A. C. S., William E. Ladd Professor of Child Surgery at Harvard Medical School; Chief of Surgical Service, The Children's Hospital, Boston, and ROBERT E. GROSS, M. D., Associate in Surgery, the Harvard Medical School; Associate Visiting Surgeon, The Children's Hospital; Associate in Surgery, The Peter Bent Brigham Hospital, Boston. 455 pages, with 268 illustrations, Price, \$10. Philadelphia and London: W. B. Saunders Company, 1941.

It has been emphasized a number of times recently that, from a surgical point of view, a child (even more an infant) is not an adult in miniature. Indeed one of our young friends, after years of training in pediatrics, has recently hung out his shingle as a children's tonsillectomist: that would appear to some as the ultimate in specialization. However, it cannot be reiterated too often that surgery in children requires particular attention, not only because their physiologic reactions are different (the loss of blood or other fluid that would be trifling in the case of a grown person might easily tip the scales against a youngster), but also because embryologic defects and certain other conditions are much more common, and because preoperative preparation and postoperative care are always of the greatest importance.

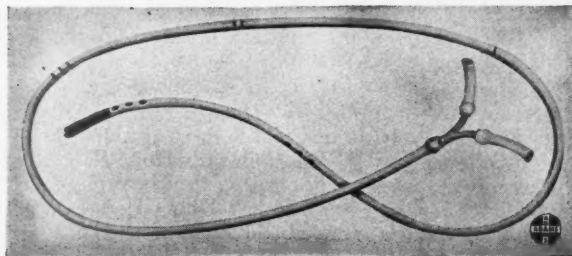
Of the authors' last 177 cases of hypertrophic pyloric stenosis, their mortality has been 0.56 per cent! Seven infants with atresia of the gut have been successfully operated on. In the majority of cases, Meckel's diverticulum has shown gastric mucosa. Ninety-five per cent of foreign bodies swallowed pass uneventfully; the remainder represents for the most part open safety pins. They disapprove absolutely of attempts to reduce intussusception by means of a barium enema: they have no mortality when operation is performed within twenty-four hours of onset. This reviewer is really delighted to learn that less than 5 per cent of their appendectomies are performed through a McBurney incision!

This book is not only clearly written but also it is so carefully written that it is entertaining. Their discussions of embryology are pellucid. The illustrations are fine. The only disappointment that we experienced was (since the junior author has done so much to put this operation on the surgical map) that the surgical treatment of patent ductus arteriosus was omitted: perhaps it was decided this should not be performed on the very young. Perhaps, since certain other highly specialized procedures are also omitted, they felt they should limit themselves to those operations that a well trained general surgeon may be called upon to perform.

This new book from The Children's Hospital in Boston deserves the study of every general surgeon who is called upon to operate on the very young.

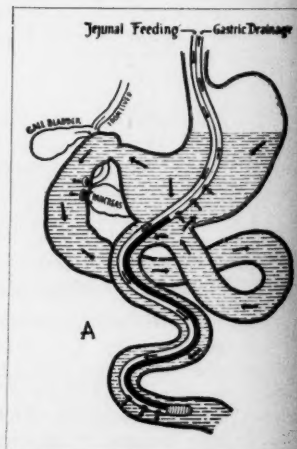
In short the book is superlative.

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